Jorgensen Forge Outfall Site
Seattle, Washington

Source Control Action

15-inch and 24-inch Pipes Cleanout Work Plan

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FINAL

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List of Abbreviations and Acronyms

Abbreviation/ Acronym	Definition
CDF	Controlled density fill
City	City of Tukwila
CMP	Corrugated Metal Pipe
County	King County
Farallon	Farallon Consulting, Inc.
Jorgensen Property	Jorgensen Forge Corporation Property
KCIA	King County International Airport
LDW	Lower Duwamish Waterway
NOV	Notice of violation
Order	Administrative Order on Consent
PBS	PBS Engineering and Environmental
PCB	Polychlorinated biphenyl
Pipes	15-inch and 24-inch Property Line Storm Pipes
Plant 2	Boeing Plant 2 Facility
SCL	Seattle City Light
SDMH	Storm drain manhole
SVOC	Semivolatile organic compound
USEPA	U. S. Environmental Protection Agency
Work Plan	15-inch and 24-inch Property Line Storm Pipes Cleanup Work Plan

1.0 Introduction

This 15-inch and 24-inch Property Line Storm Pipes Cleanup Work Plan (Work Plan) details the source control action that includes cleanout and sealing procedures proposed for the 15-inch[1] and 24-inch Property Line Storm Pipes (collectively, Pipes) located on the Jorgensen Forge Corporation Property at 8531 East Marginal Way South in Seattle, Washington (Jorgensen Property; Figure 1). The Work Plan has been produced on behalf of The Boeing Company (Boeing). Previous investigations conducted within the Pipes have documented the presence of elevated concentrations of polychlorinated biphenyls (PCBs) in solids within the Pipes. The U.S. Environmental Protection Agency (USEPA) Office of Emergency Response has been designated as the lead agency for ensuring the PCBs within these Pipes are not a source of contamination to the adjacent Lower Duwamish Waterway (LDW). The remainder of this Work Plan details the scope of work to:

- investigate the nature and extent of contamination related to the Pipes, and
- clean and seal the Pipes to eliminate the potential for discharges from these Pipes to the LDW.

1.1 BACKGROUND

Following early settlement and the re-configuration of the LDW in the early 1900s, a "drainage ditch" existed near the current Property Line separating the currently existing Boeing Plant 2 Facility (Plant 2) property and the Jorgensen Property. Historical aerial photographs suggest that this drainage ditch was first used for agricultural drainage purposes up until the 1930s when it was likely used to drain a portion of the newly-constructed Boeing Field Airport. Development of the Plant 2 and Jorgensen properties that began in the mid 1940s led to the installation of the two Pipes:

- A subsurface 15-inch Property Line Storm Pipe (15-inch Pipe) that served as the stormwater outfall for a portion of the south side of Plant 2.
- A subsurface 24-inch Property Line Storm Pipe (24-inch Pipe) that drained an additional portion of the south side of Plant 2, a portion of the Boeing Field Airport (now known as King County International Airport [KCIA]), and a portion of the historic Bethlehem Steel Facility located on the Jorgensen Property.

In 1996 the City of Tukwila (City) began discharging stormwater runoff to the 24-inch Pipe that was captured from catch basins located along East Marginal Way South.

In 2001, a Boeing infrastructure project in the southwest corner of Plant 2 identified PCB impacted soil adjacent to and between the former Seattle City Light transformer substation and the fence line marking the boundary between the Plant 2 and Jorgensen properties. A phased environmental investigation was conducted by Boeing to define the nature and extent of PCB impacts. The Phase 1 Transformer PCB Investigation Report (Floyd Snider McCarthy, Inc. 2004) concluded that the stormwater conveyance system serving the transformer and wider area was a completed pathway for PCBs to the LDW sediments. Due to this completed pathway, Boeing conducted further soil sampling in the wider area and solids sampling from the

[1] The 15-inch Pipe is also referred to as the "12-inch pipe" in other documents that are quoted and referenced throughout this Work Plan.

nearby storm drainage systems including both Pipes. The results of this investigation were summarized in the Phase 2 Transformer Investigation Report (Floyd|Snider and Weston Solutions 2005), which showed elevated concentrations of PCBs in solids within both of the Pipes. It was concluded, however, that the PCBs discovered as a source in soil adjacent to the transformer substation had not migrated into either of the Pipes.

Active stormwater discharges to the 24-inch Pipe were occurring from the KCIA and City drainage areas during the 2005 investigation. At the time this Work Plan was developed, the KCIA discharges had been rerouted and the City was in the final stages of evaluating rerouting of their discharges. Plant 2 eliminated its discharges to both Pipes in approximately the mid-1990s. There is no documentation when the Bethlehem Steel Facility eliminated their discharges to the 24-inch Pipe, but the discharges are anticipated to have stopped in the mid-1960s when the Facility was dismantled.

On November 7, 2008, the Washington Department of Ecology (Ecology) issued a Notice of Violation (NOV; No. 6180) to King County (County) and the City for the discharge of stormwater through an area of known contamination (Ecology 2008) in the 24-inch Pipe.

The County and the City jointly responded to the NOV, stating that they were not responsible for any remedial action of the downgradient portion of the 24-inch Pipe located on the Jorgensen Property (King County and City of Tukwila 2008).

In 2010, Ecology transferred oversight of the 24-inch Pipe cleanup actions to the USEPA Office of Emergency Response. USEPA is in the process of issuing an Administrative Order on Consent (Order) to Jorgensen Forge and Boeing to clean out and seal the concrete sections of the 24-inch and 15-inch Pipes as described in this Work Plan. At the time of the Work Plan preparation, the Order was in progress (estimated for execution in late 2010). The Order has within it the following objectives:

1. Eliminate stormwater discharges from the Pipes to the LDW.
2. Remove the solids and associated contamination from the Pipes.

Boeing has taken the lead in this project and therefore is responsible for developing this Work Plan in conjunction with the above-mentioned Order. In addition to the objectives above, a further objective will also investigate the source, nature, and extent of contamination as part of the Work Plan. This Work Plan is being submitted to document the procedures proposed to achieve these objectives and report on those activities once these objectives are achieved. This work will be incorporated by reference in the Order.

1.2 WORK PLAN ORGANIZATION

The remainder of the Work Plan is organized into the following sections:

- Section 2.0—Summary of Existing Information
- Section 3.0—Scope of Work for Proposed Cleanout
- Section 4.0—Completion Reporting
- Section 5.0—Schedule
- Section 6.0—References

2.0 Summary of Existing Information

The following sections provide a summary of the existing information that supports planning for the cleanout of the Pipes.

2.1 SUMMARY OF NEARBY INVESTIGATIONS

Existing information on the Pipes was gathered primarily as part of other nearby investigations. The following subsections provide a summary of the nearby investigations.

2.1.1 Boeing—Phase 1 Transformer PCB Investigation Report

The information included in Sections 2.1.1.1 and 2.1.1.2 is drawn from the Phase 1 Transformer PCB Investigation Report (Floyd Snider McCarthy, Inc. 2004). Text excerpted directly from the report is included in quotes. Clarifications of the excerpts are included in brackets.

2.1.1.1 Introduction

"In mid 2001, Boeing informed USEPA of Boeing's replacement of curbing on the southern portion of the Boeing Facility, including adjacent to an electrical substation with transformer equipment owned and operated by Seattle City Light (SCL). As part of the curbing replacement, soil samples from an excavation near the transformers were collected and submitted for laboratory analysis of polychlorinated biphenyls (PCBs). The results indicated high concentrations of PCBs. Based on these results, Boeing excavated an area measuring approximately 6 feet by 10 feet by 3 feet deep to remove contaminated soil and to further define the extent of PCBs (see Photo A.1, included in Appendix A of this Work Plan).

Analyses of samples collected by Boeing during August 2001 from the sidewalls and bottom of the excavation (termed the 'Area of Discovery') revealed PCB concentrations ranging from less than 37 µg/kg to 460,000 µg/kg."

2.1.1.2 Conceptual Site Model

"Historically, the primary pathway for a surface spill/leak in the transformer area (as evidenced by the Area of Discovery) is believed to be transported to the waterway through the [Plant 2 Facility] stormwater system."

2.1.1.3 Conclusion

The Phase 1 Transformer Investigation Report concluded that additional investigation was required to determine all current or historic pathways to the LDW including via the Pipes.

The Phase 2 Transformer PCB Work Plan (Floyd|Snider and Weston Solutions 2004) was developed to fill these data gaps.

2.1.2 Boeing—Phase 2 Transformer PCB Investigation Report

The information included in Sections 2.1.2.1 and 2.1.2.2 is drawn from the Phase 2 Transformer PCB Investigation Report (Floyd|Snider and Weston Solutions 2005). Text excerpted directly from the report is included in quotes. Clarifications of the excerpts are included in brackets.

Please refer to Appendix A, which includes a reproduction of Figure 3.7 of the Phase 2 Transformer PCB Investigation Report (referenced in the following subsections).

2.1.2.1 Storm System Survey

"The purpose of the storm system survey was to determine the alignment and condition of existing pipes and to identify any unknown connecting pipes. Prior to the Phase 2 survey, the alignment, integrity, and connections of various components of the [Plant 2 Facility] storm system [serving the vicinity of the Area of Discovery] could not be firmly established. Therefore, the potential existed for PCBs in soil or groundwater to enter the [Plant 2 Facility] storm system through cracks and joints and become redistributed within the solids of the system, thereby making these pipes a possible active pathway for the migration of PCBs from the substation area to the waterway…"

"…The two other major storm systems of interest both lie outside of Plant 2, on the Jorgensen Forge Property and consist of a 12-inch ID storm pipe that formerly drained Plant 2 and a 24-inch storm pipe that drains King County International Airport (KCIA) and formerly drained a portion of Plant 2. These are referred to as the two parallel 'Property Line Storm Pipes.'"[2]

2.1.2.2 Storm Survey and Solids Sampling Results

The results of the storm survey within the Transformer Investigation Area are shown in Appendix A, Figure 3.7. Significant findings from the survey within the Transformer Investigation Area are as follows:

- "Each storm system was found to be intact (upon review of the video) and have integrity (i.e., no broken, severely cracked, or missing sections of pipe were found) except for both Property Line Storm Pipes at a point just prior to their outfalls where a significant separation of the corrugated metal pipe was observed that prevented further survey."
- "No cross connection between these three systems and/or the substation area was found."
- "For the 24-inch Property Line Storm Pipe originating at KCIA, the following observations were made for that section transiting the Transformer Investigation Area (refer to Appendix A, Figure 3.7):
  - One manhole along the 24-inch pipe was discovered (designated SDMH 24A) having been obscured by gravel.
  - A 12-inch diameter pipe coming in from the Jorgensen Forge was discovered approximately 12 feet upgradient of SDMH 24A…"

[2] For clarification, the "12-inch ID Storm Pipe" referred to in this excerpt is called the 15-inch Pipe throughout this Work Plan.

- "…For the 12-inch Property Line Storm Pipe, the following observations were made for that section transiting the Transformer Investigation Area:
  - PCB concentrations in the solids within SDMH 15A located approximately 50 feet east of the Area of Discovery contain elevated levels of PCBs (350,000 µg/kg)…"
- "…For those sections of both Property Line Storm Pipes that lie upgradient of the Transformer Investigation Area, the following observations were noted (and reported here for broader source control purposes):
  - A second manhole, designated 24B, was discovered along the 24-inch Property Line Storm Pipe, approximately midway between East Marginal Way and the Duwamish Waterway.
  - The 15-inch concrete pipe originating on Plant 2 that is shown connecting to the 24-inch pipe via SDMH 37-7 as portrayed in construction drawings was verified to exist and verified to be inactive.
  - Two heretofore unknown pipes (12-inch and 6-inch) were noted leading into the "Public" SDMH near East Marginal Way and appear to be inactive".
  - The 12-inch Property Line Storm Pipe system[3] was verified to originate entirely within Plant 2, and verified to be inactive.
  - The concentration of PCBs in the storm solids at the base of all manholes along these two piping systems are elevated (all sample results are greater than 100,000 µg/kg)." was verified to originate entirely within Plant 2, and verified to be inactive."

2.1.2.3 24-inch Pipe Construction

No as-built drawings have been identified for the construction of the 24-inch Pipe, so this information was collected during completion of the Phase 2 Transformer PCB Investigation Report (Floyd|Snider and Weston Solutions 2005). The 24-inch Pipe is constructed of 24-inch concrete and 24-inch Corrugated Metal Pipe (CMP). The CMP portion of the pipe extends from the outfall approximately 70 lineal feet to the west on the Jorgensen Property and transitions to the 24-inch concrete pipe without a connecting structure. There are three known inactive laterals along the 24-inch Pipe, two entering from the Jorgensen side and one from the Boeing side. One of the two Jorgensen laterals is located 18 feet west of Manhole 37-2 nearby the current Jorgensen Forge main office near East Marginal Way. The 2005 video survey identified it as a "plugged connection" and it appears to be approximately 6 inches in diameter. No further information is currently available regarding this lateral. The second is a 12-inch clay lateral that enters the 24-inch concrete portion further downstream near Manhole 24A, as discussed in more detail below. The Boeing connection consists of a single 15-inch concrete lateral that enters the concrete portion from Plant 2 further upgradient to the east. The total length of the 24-inch concrete portion of the pipe is approximately 1,330 lineal feet. The locations of the CMP sections, concrete sections, and lateral lines are shown on Figures 2 and 3.

2.1.3 15-inch Pipe Construction

No as-built drawings have been identified for the construction of the 15-inch Pipe, so this information was collected during completion of the Phase 2 Transformer PCB Investigation

[3] For clarification, the "12-inch Property Line Storm Pipe" referred to in this excerpt is called the 15-inch Pipe throughout this work Plan

Report (Floyd|Snider and Weston Solutions 2005). The 15-inch Pipe is constructed of 15-inch concrete and 15-inch CMP. The CMP portion of the pipe extends from the outfall approximately 70 lineal feet to the west on the Jorgensen Property and transitions to the 15-inch concrete pipe without a connecting structure. At SDMH 15B, the 15-inch concrete pipe angles northeast onto the Plant 2 Property (Figure 2). The total length of the 15-inch concrete portion is approximately 680 lineal feet. The locations of the CMP and concrete sections and the orientation of the pipe are shown on Figures 2 and 3.

2.1.4 Farallon—Storm Drain Line Data Summary

Following completion of the Phase 2 Transformer Investigation Work Plan (Floyd|Snider and Weston Solutions 2004) activities, Farallon Consulting, LLC (Farallon), on behalf of Jorgensen, conducted sampling to characterize the PCB concentrations in solids residing within the historical 12-inch lateral connection (assumed to have served the Bethlehem Steel Facility located on the Jorgensen Property) to the 24-inch Pipe. A sample was collected from within the 12-inch lateral, just upgradient from the connection to the 24-inch Pipe and just downgradient from a piece of dimensional lumber—located approximately 40 feet upgradient of the connection—that was identified in the lateral during the video reconnaissance survey conducted during completion of the Phase 2 Transformer Report (Floyd|Snider and Weston Solutions 2005) activities.

The results of this additional characterization were summarized in a technical memorandum titled “Storm Drain Line Data Summary” (Farallon 2005). The memorandum reported that “concentrations of total PCBs detected in the samples collected by Farallon from the 12-inch line ranged from 1,100,000 µg/kg collected approximately 6 inches from the connection from the 24-inch line to 6,500 µg/kg collected approximately 40 feet from the connection with the 24-inch line.” Farallon obtained the furthest upgradient soil samples from within the 12-inch lateral by completing a single boring that broke through the lateral. Following the sample collection, the downgradient boring hole was filled with controlled density fill (CDF), thereby plugging the 12-inch lateral at the sampling location.

2.1.5 Tukwila—PCB Source Control Investigation of the City of Tukwila Stormwater System

In response to Ecology’s NOV (No. 6180), the City collected a single solid sample and water sample from the “Public” storm drain manhole (SDMH, Public SDMH 11/SD006/CB 4.005) near East Marginal Way South, located just east of the Jorgensen fence line, in 2008. The results were summarized in the PCB Source Control Investigation of Tukwila Storm System (PBS 2008). The solid and water samples had a PCB concentration of 100,000 milligrams per kilogram dry weight (µg/kg dw) and 22 micrograms per liter (µg/L), respectively.

2.1.6 Jorgensen—12-inch Lateral Connection Investigation

As detailed in subsection 2.1.4, Farallon previously conducted a video reconnaissance survey within the 12-inch lateral; this survey extended just upgradient from the connection to the 24-inch Pipe to a piece of dimensional lumber located approximately 40 feet upgradient of the connection. In May 2010, Anchor QEA conducted an additional investigation within the 12-inch lateral to delineate the drainage and potential presence of solids within the area of the lateral upgradient of the piece of dimensional lumber. Soil was excavated to expose the portion of the 12-inch lateral just upgradient of the dimensional lumber, and the clay pipe was broken to facilitate upgradient video reconnaissance. The video reconnaissance confirmed that the 12-inch lateral extended approximately 35 feet upgradient of the dimensional lumber, where the pipe terminated. No lateral connections were identified in the 12-inch lateral within this short distance.

An additional soil excavation was conducted to provide access to the termination point identified by the video reconnaissance to facilitate further evaluation of the nature of the termination point (that is, pipe collapse versus end of pipe) and to determine if a solids sample could be collected in the pipe at the termination point. Once accessed, additional excavation was conducted upgradient of the termination point for several feet and no pipe was identified indicating the termination point was the end of pipe. A single solids sample was collected from within the pipe at the termination point and submitted for PCB analysis.

2.2 NATURE AND EXTENT OF CHEMICAL CONCENTRATIONS

The following subsections provide a summary of the nature and extent of chemical concentrations identified within the concrete portions of the Pipes as reported in "Storm Drain Line Data Summary" (Farallon 2005) and PCB Source Control Investigation of Tukwila Storm System (PBS 2008).

2.2.1 24-inch Pipe

Five solids samples were collected and analyzed from the concrete portion of the 24-inch Pipe and lateral connections on the Jorgensen Property. PCB Aroclor® 1254 was detected in all solids samples in the 24-inch Pipe samples ranging from 68,000 milligrams per kilogram dry weight (µg/kg dw) in the most up-gradient manhole SD006 to 10,000,000 µg/kg dw in the most down gradient location SD005 (Figure 2). A 12-inch clay lateral (from Bethlehem Steel) and 15-inch concrete lateral pipe (from Plant 2) connect to the 24-inch Pipe with sample concentrations of 1,100,000 µg/kg dw and 730,000 µg/kg dw respectively at the outlet end of the laterals. The sample results are presented in Table 1.

2.2.2 15-inch Pipe

Two solids samples were collected and analyzed from the concrete portion of the 15-inch Pipe. The sample from SDMH 15A was taken in two intervals (top 9 and bottom 3 inches of solids) and run discretely and as a composite. The SDMH 15A sample top 9 inch, bottom 3 inch and composite sample resulted in concentrations of 7,200, 350,000 and 79,000 µg/kg dw, respectively, consisting primarily of PCB Aroclors ® 1248 and 1254 with a trace amount of 1260. A single discrete solid sample collected from SD003 resulted in 140,000 µg/kg dw of PCB Aroclor ® 1254. Additional waste profiling for metals and SVOCs was conducted by Boeing on the material in the base of MH15A within the 15-inch line. The results did not indicate detections of these chemicals. Tables containing the results of the waste profiling (Tables F.1 and F.2 from the Phase 2 Transformer PCB Investigation Report [Floyd|Snider and Weston Solutions 2005]) are contained in Appendix A. The results of 15-inch Pipe samples are summarized in Table 2.

3.0 Scope of Work for Proposed Source Control Action

This section provides the scope of work to remove solids, seal, and eliminate discharges from these Pipes to the LDW and to investigate the nature and extent of contamination related to the Pipes.

3.1 CONCRETE PORTION

This phase of work will address the sealing and cleanout of the concrete portion of the Pipes. Following cleaning, the Pipes will be permanently sealed and plugged at the downgradient intersection between the CMP and concrete portions. The 24-inch Pipe will be permanently plugged in the upgradient location at approximately the eastern boundary of the Jorgensen Property, accessed through the “Public” manhole located just east of the Jorgensen Property fence line. The 15-inch Pipe was permanently plugged in the upgradient location by Boeing in the mid-1990s.

The full extent of the concrete portions of the Pipes will be cleaned between the downgradient and upgradient closure locations. In addition, the accessible laterals entering the Pipes will be cleaned upgradient from their connection points with the Pipes, as feasible based on the cleaning techniques employed. The proposed sealing locations and limits of the concrete pipe cleaning are presented on Figure 3.

The work described below will be conducted in accordance with the Quality Assurance Project Plan (Appendix B) and consultant Health and Safety Plan (HASP; Appendix C), which will be submitted to USEPA in accordance with the Order. In addition, the contractor shall provide and comply with the HASP specific to the nature of their work (e.g., confined space entry). A daily safety briefing will be conducted with all on-site personnel prior to commencing field activities.

3.1.1 Tidal Survey

Prior to cleanout work, a tidal survey will be performed in each accessible manhole between the outfall of the 24-inch Pipe and East Marginal Way. As shown on Figure 3, there are five accessible catch basins in which pressure transducers can be placed.

Using the transducer data and the measured depth and elevation of the manhole, the elevation of the water in the manhole will be determined and compared to the tidal cycle. The pressure transducers also measure conductivity and temperature, which will be used to determine the salinity of the water in the pipe.

In order to get an accurate depiction of the varying water levels over representative tidal cycles, the transducers will be left in place for approximately 2 weeks prior to any pipe cleanout activities. The data collection will be conducted over a period that includes a high tide of at least 12 feet Mean Lower Low Water (MLLW). In addition to the transducers in the manholes, another transducer will be placed in the Duwamish Waterway to measure the elevation of the river over the same 2-week period. The river transducer will be installed vertically alongside a fixed structure such as a piling. The elevations of each manhole lid and bottom of each catch basin and lateral will be determined by a professional surveyor and used to calculate the elevation of the water levels measured by the transducer.

Although the survey is intended to take place during a dry period, it is possible that rain will occur and the elevations of water within the 24-inch Pipe will be elevated due to stormwater entering the system from East Marginal Way. Hourly measurements of rain as recorded at KCIA will be used to note rain events on the final charts.

3.1.2 Performance Standards for Cleaning and Sealing

As discussed in Section 1.0, the cleaning and sealing objectives of the Order are to:

1. Eliminate stormwater discharges from the Pipes to the LDW, and
2. Remove the solids and associated contamination from the Pipes.

Contractor achievement of Objective 1 will be assessed by verifying that the Pipe sealing points identified in Figure 3 have been sealed, thereby eliminating discharges to the LDW. Full blockage at the seal points will be verified by inspection and photography of the closure points. Contractor achievement of Objective 2 will be assessed through a post-cleanup video reconnaissance survey to document that the visible solids and standing water within the cleaned portions of the Pipes are removed.

3.1.3 Pipe Sealing

Objective 1 will be achieved by sealing the Pipes to eliminate discharge to the LDW. The method of sealing will be based on discussions with the selected contractor, but the anticipated methods are either: (1) plugging the Pipes with concrete or CDF, or (2) verifying that locations that may have already been plugged, such as laterals, were done so in a permanent manner. The proposed sealing locations, shown on Figure 3, are:

- transition between the CMP and concrete portions of both Pipes,
- upgradient of SDMH 15B within the 15-inch Pipe angling onto Plant 2,
- downgradient pipe entrance to the 24-inch Pipe within the “Public” manhole located just east of the Jorgensen Property fence line,
- upgradient of SDMH 37-7 within the 15-inch lateral connection to the 24-inch Pipe,
- each manhole location providing access to the Pipes on the Jorgensen Property, excluding the “Public” manhole located just east of the Jorgensen Property fence line.

There is no structure at the transition between the CMP and concrete portions of the Pipes; therefore, in order to perform the temporary and final plugging at the transition point to CMP, soil will be excavated to expose the transition area. Sufficient excavation and shoring will be implemented as necessary to facilitate safe access to perform the sealing (and potentially cleanout) activities. Tidal conditions will be considered when scheduling the excavation activity, because the entire length of the line on the Jorgensen Property exists within the tidal flushing elevations.

3.1.4 Pipe and Lateral Cleaning

3.1.4.1 Pipe Jetting

Objective 2 will be achieved by removing solids and associated chemicals within the Pipes and laterals between the closure locations shown on Figure 2. The method of cleanout will be based on discussions with the selected contractor, but the anticipated method is washing the Pipes and associated accessible laterals.

Jet washing, which has been employed previously to clean stormwater drainages at the Plant 2 Facility and Jorgensen Property, involves a jetting nozzle with five jets, with four angled backwards and one facing forward. The jetting nozzle is attached to a high-pressure rubber hose connected to a pressurized vessel on a truck. The jetting nozzle is self-propelled by the backwards-directed water jets. The jetting will loosen solids from the entire pipe diameter, with an emphasis on the base of the pipes where the bulk of the solids occur. The jet washing activities will be conducted through sequential plugging of the pipe as described below so that no wash water or solids will discharge to the LDW. Previous video reconnaissance conducted by Boeing as part of the Phase 2 Transformer Investigation Work Plan (Floyd|Snider and Weston Solutions 2004) identified solids accumulations below the Pipe manhole locations identified on Figure 2. It is anticipated that the base of each manhole will be cleaned by pumping out these solids and any accumulated water, followed by pressure washing[4] and vacuuming of loosened solids and accumulated wash waters through the remainder of the Pipes and laterals. Beginning at the most upgradient manhole, the solids within each horizontal pipe segment will be flushed by high pressure water jetting and vacuumed at the nearest downgradient manhole, which will be temporarily blocked as necessary to allow accumulation of wash water and solids within that segment of the pipe being cleaned. It is anticipated that a technician stationed in the manhole will direct the jetting hose forward into the downgradient pipe segment approximately half the distance to the next manhole. The hose will then be withdrawn to re-clean the pipe and/or lateral in the opposite direction. As this is done, wash water and solids will be vacuumed from the downgradient and upgradient manholes. The technician will move to the next downstream manhole and then clean the downgradient and upgradient segments to the halfway points, and so on.

The 15-inch lateral leading to Plant 2 will be cleaned to the point of abandonment in a similar manner, as this lateral can be accessed from Manhole 37-7.

A video survey will be performed following the cleaning to verify that solids and wash waters have been removed. Cleaning will be repeated as necessary until the Pipes and accessible laterals are visibly free of solids. Waters and solids will be managed for waste characterization and disposition, as described in the next subsection.

The video survey will also be used to confirm that there are no other additional laterals. If an additional lateral is found, USEPA will be notified and the contractor will attempt to trace its route using the video camera or by use of ground penetrating radar (GPR) or other means. If the lateral is not plugged, the contractor will clean and close it using the methods described in previous sections. The Jorgensen lateral, located 18 feet west of Manhole 37-2, appears to be plugged in the video survey; however, the length is unknown. The contractor will attempt to

[4] If necessary, a technician (using confined space entry protocols) will enter each manhole to effectively dislodge accumulated solids.

trace the route of this lateral by use of either GPR or a sonde locator. If necessary, a test pit may be used to confirm the termination point of the lateral.

3.1.4.2 Water/Solids Collection, Treatment, and Disposal

Water and solids generated by the cleaning of catch basins will be vacuumed together as they are generated and as they accumulate by gravity at successive temporarily-plugged downgradient manholes. Regardless of the cleanout and closure sequencing, the wash water and liberated solids generated from the cleaning will be captured to prevent discharge to the LDW. As discussed in Section 3.1.2, there is no manhole at the transition between the CMP and concrete portions of the Pipes, so soil is expected to be excavated to expose the transition area to allow the temporary plugging and cleaning of the most downgradient sections of the concrete portions of the Pipes. The temporary plugs will prevent upgradient wash waters from discharging out the end of the concrete pipes to the soils below. Following the removal of wash waters and solids, the temporary plugs will be removed and the end of the Pipes permanently sealed with concrete, as described above. Alternative methods proposed by potential contractors during the bid process will be considered and employed if effective in meeting the objectives of the work.

Solids and waters will be accumulated in a vacuum truck and the waters segregated either for onsite treatment and permitted sanitary discharge or for off-site treatment and disposal by a licensed treatment/storage/disposal facility. Solids will be dewatered and stabilized and drummed and sent off site for disposal/treatment at the proper permitted facility. Disposal of the water and solids may entail limited profile sampling to facilitate permitted sanitary discharge or waste determinations.

3.1.5 Contractor Oversight of Pipe Sealing and Cleanout Operations

A designated field technician will observe and document all sealing and cleanout procedures. The field technician will document the following:

- All excavations, exposed pipe, and any boring, cut, or other such hole used to access the interior of the Pipes and accessible laterals.
- Description of solids material noted within the interior of the Pipes and/or accessible laterals prior to cleanout.
- Native or fill material immediately surrounding the Pipes and accessible laterals in excavated or otherwise exposed areas.
- Closure mechanisms employed (e.g., concrete, CDF, expansion plugs, etc.).
- Water and material accumulated during cleanout prior to removal.

The field technician will verify and document that all accessible Pipes and laterals have been cleaned out and all applicable pipe and lateral entrances and connections have been sealed using approved and appropriate means. The technician will ensure that cleanout and sealing of all accessible pipes and laterals is recorded on the post-cleanout video survey. Pipe cleanout and sealing operations will be considered complete when no solids are visible in the video survey.

3.1.6 Solids Sampling

Prior to cleaning, samples of solids material will be collected along the 15-inch and 24-inch Pipes and within accessible laterals. Solids samples will be collected from the base of each storm drain manhole and from each opening created in the Pipes or accessible laterals for sealing and cleanout access. Additional samples of solids from the interior of the Pipes and from excavated material may be collected at the discretion of the field technician based on field observations and accessibility. This may include collecting samples within or associated with other nearby storm drains or outfalls, including Jorgensen Outfall 9 and the 6-inch lateral pipe that enters from the Jorgensen Property into Boeing Storm Drain 36-83, near the former SCL transformer pad.

Due to access constraints and safety issues, samples will likely be collected remotely or by the contractor and transferred to the field technician. The field technician is responsible for filling sample containers, logging, and delivering samples to the laboratory in accordance with the Quality Assurance Project Plan (Appendix B- to be provided in accordance with the Order). Details of expected analysis to be performed, along with field and laboratory QA/QC procedures, are also contained in Appendix B. Samples will be analyzed for parameters detailed on Table 3. Additional samples may be collected and archived for future analysis.

3.1.7 Corrugated Metal Pipe Investigation

Investigating the nature and extent of contamination in the area of the bank traversed by the CMP portions is necessary prior to planning and implementation for any future remediation related to releases from the CMP. The goals of the CMP investigation comprise the following:

- Define the nature and extent of contamination, if any, in fill material overlying the CMP section of the Pipes. This overlying fill will need to be excavated to remove the pipes and therefore needs characterization.
- Define the nature and extent of contamination, if any, in soil adjacent to and underlying the CMP section of the Pipes to verify if underlying soil is potentially contaminated due to releases of stormwater-associated contamination from CMP holes and breaks.

This investigation will primarily involve the collection of subsurface soil samples and groundwater using a truck-mounted Geoprobe®. Borings will occur along up to five transects parallel to the CMP portions as shown on Figure 4. Three to five points will be sampled along each transect. The southernmost transects would be probed if there is fill and/or debris noted at the previous adjacent transect.

Three to five discrete samples will be collected per boring or until native soil is encountered. Samples will be analyzed for PCBs, metals, and SVOCs. The northern three transects will likely encounter VOC contamination related to solvents near well JF01A and, therefore, samples along these transects will also be analyzed for VOCs. Groundwater samples will also be collected via Geoprobe and analyzed for VOCs. Certain samples along the most southern transects will be archived for possible future analysis depending on results along the initial transects. Further details on the proposed sampling and analysis will be provided in the Quality Assurance Project Plan (Appendix B) and the HASP (Appendix C), to be provided in accordance with the Order.

4.0 Completion Reporting

4.1 SOURCE CONTROL ACTION

Following USEPA's approval and implementation of the Work Plan, a completion report will be submitted to USEPA to document, at a minimum, the following actions:

- The tidal survey data obtained within the manholes.
- Methods used to close the upgradient and downgradient locations of the Pipes and documentation of successful sealing.
- Pipe cleaning process and documentation that the cleaning performance objective was achieved. Documentation of collection, treatment, and disposal of solid and rinsate materials.
- Results of the CMP Investigation, including boring locations, boring logs, and results of analysis performed.

Field documentation will consist of photographing each manhole location, condition of pipe beneath each manhole prior to cleaning (for example, the depth of water and odor of solids and debris), line segment cleaned, start and stop times, the volume of water and approximate quantity of solids removed, volume of concrete plug, and other activities. Photographs of the manholes and the ends of the pipe will be taken upon completion, and a DVD of the final video survey will be provided.

5.0 Post Removal Site Control

It is not anticipated that post removal site controls (e.g., institutional controls, inspections or maintenance) will be necessary to guarantee long-term environmental protection. This is because the Pipes will be cleaned of PCB-containing debris, and also permanently abandoned by the concrete seals placed at both ends of the Pipes and also at every manhole in between. The only remaining discharge of stormwater to the Pipes is the limited discharge currently occurring along East Marginal Way to the "Public Manhole. Based on initial conversations with the City of Tukwila during 2010, it is understood that this stormwater will be diverted by the City of Tukwila to catch basins further down East Marginal Way following sealing of the "Public Manhole" along East Marginal Way.

6.0 Schedule

The proposed implementation schedule is detailed in Table 3.

As shown in Table 3, sealing of the Pipes is planned for early 2011 but the exact timing for implementation of the Pipe and lateral cleanouts and sealing, as well as the investigation activities, will be dependent on the following factors:

- Order execution.
- Confirmation that the City has eliminated its discharges to the 24-inch Pipe.
- Receipt of an approval permit from the County to discharge the collected wash water to the County system under a Waste Discharge Permit (if the rinsate meets the Permit criteria).
- Receipt of approval from the City to access the “Public” SDMH in order to close the downgradient entrance to the 24-inch Pipe.
- Contractor availability.
- Tidal schedule allowing safe working conditions during daylight hours.
- Regional rainfall conditions.

7.0 References

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Jorgensen Forge Outfall Site
Seattle, Washington

Source Control Action

15-inch and 24-inch Pipes Cleanout Work Plan

Tables

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Table 1
24-inch Outfall Drainage Structures and Identified Polychlorinated Biphenyl Concentrations

Location/Sample	Sampling Location Characteristics	Sample Date	Sample Collected By:	Total PCBs (µg/kg dw)
SDMH 24A/SD005	24-inch diameter concrete	5/3/2005	Boeing/ Weston Solutions	10,000,000
12-SD-070105-01	12-inch diameter clay	7/1/2005	Jorgensen/Farallon	1,100,000
12-SD-070105-02	12-inch diameter clay	7/1/2005	Jorgensen/Farallon	6,500
SDMH 24B/SD004	24-inch diameter concrete	5/3/2005	Boeing/ Weston Solutions	2,400,000
MH 37-7/SD002	24-inch diameter concrete	5/3/2005	Boeing/ Weston Solutions	730,000
MH 37-2/SD001	24-inch diameter concrete	5/2/2005	Boeing/ Weston Solutions	2,600,000
"Public" SDMH 11/SD006/CB 4.0005	24-inch diameter concrete	6/3/2005	Boeing/ Weston Solutions	68,000
	24-inch diameter concrete	10/2/2008	City/PBS Engineering and Environmental (PBS)	100,000

Abbreviation:
PCB Polychlorinated biphenyl

Table 2
15-inch Outfall Drainage Structures and Identified Polychlorinated Biphenyl Concentrations

Location/ Sample	Sampling Location Characteristics	Sample Date	Sample Collected By:	Total PCBs (µg/kg dw)
SDMH 15A	CB10 (Composite)	4/8/2005	Boeing/Weston	7,900
	CB011 (Top 9 inches)	4/8/2005	Boeing/Weston	7,200
	CB012 (Bottom 3 inches)	4/8/2005	Boeing/Weston	350,000
SDMH 15B	SD003	5/3/2005	Boeing/Weston	140,000

Abbreviation:
PCB Polychlorinated biphenyl

Table 3
Implementation Schedule

Task	Due Date
Submit Draft Revised Work Plan to USEPA	November 18, 2010
USEPA Approval of Revised Work Plan	Late November 2010 (est.)
Administrative Order on Consent Execution	Late November/Early December 2010 (est.)
Submit Draft QAPP and HASP to USEPA	Early December 2010
USEPA Approval of QAPP	Late December 2010 (est.)
Tidal Study	December 2010
Concrete Pipe and Laterals Cleanout and Sealing Field Activities	January–February 2010 (est. depending on Order Execution and Work Plan Approval)
CMP Investigation	January–February 2010 (est. depending on Order Execution and Work Plan Approval)
Completion of Field Activities	30 days after field activities begin; dependent on, permitting, contractor availability and weather conditions
Submit Draft Completion Report to USEPA	60 days after completion of field activities and receipt of final laboratory report
USEPA Approval of Final Completion Report	30 Days after submittal of Final Report (est.)

Abbreviations:

CMP	Corrugated metal pipe
est.	Estimated
HASP	Health and Safety Plan
QAPP	Quality Assurance Project Plan
USEPA	U.S. Environmental Protection Agency

Jorgensen Forge Outfall Site
Seattle, Washington

Source Control Action

15-inch and 24-inch Pipes Cleanout Work Plan

Figures

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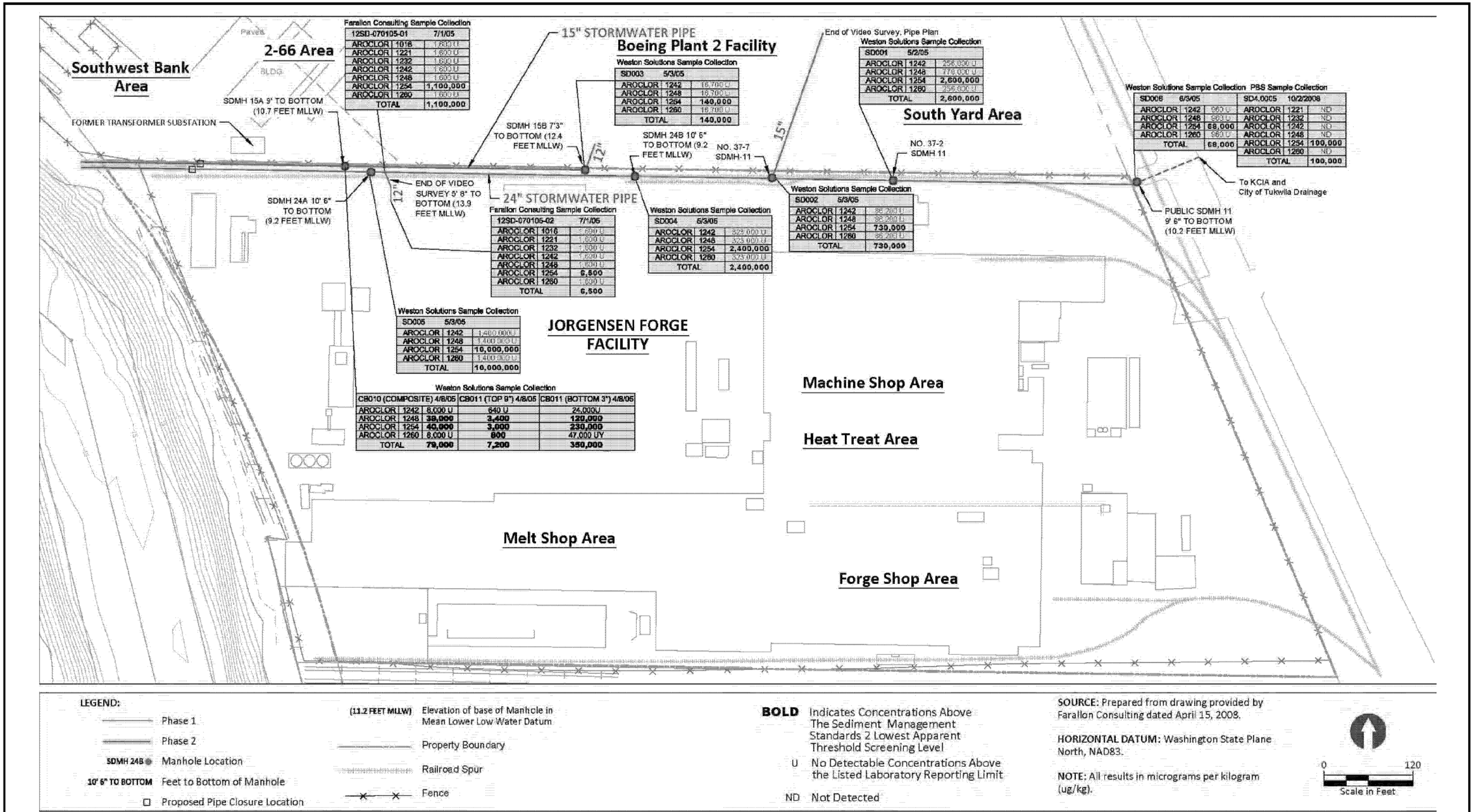
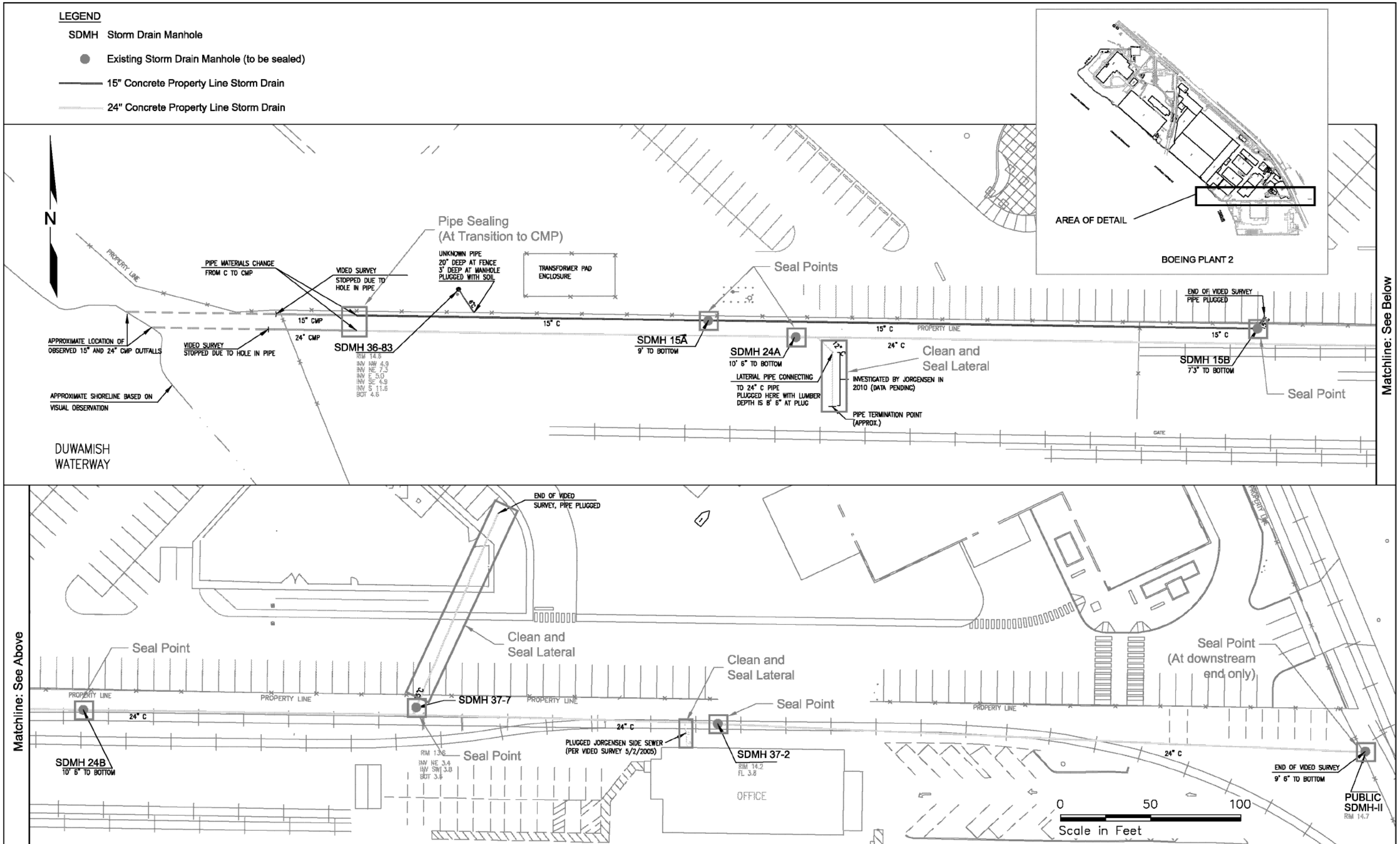
Note: Graphic taken from Figure 1 of the *Draft 15-inch and 24-inch Property Line Storm Pipes Cleanup Work Plan* by Anchor QEA, dated August 2010.

FLOYD | SNIDER strategy • science • engineering	**15-inch and 24-inch Pipes Cleanout Work Plan Jorgensen Forge Outfall Site Source Control Action Seattle, Washington**	Figure 1 Site Vicinity Map



Note: Graphic taken from Figure 2 of the *Draft 15-inch and 24-inch Property Line Storm Pipes Cleanup Work Plan* by Anchor QEA, dated August 2010.

FLOYD | SNIDER strategy ▪ science ▪ engineering	**15-inch and 24-inch Pipes Cleanout Work Plan** **Jorgensen Forge Outfall Site** **Source Control Action** **Seattle, Washington**	Figure 2 Property Line Pipes PCB Analytical Results



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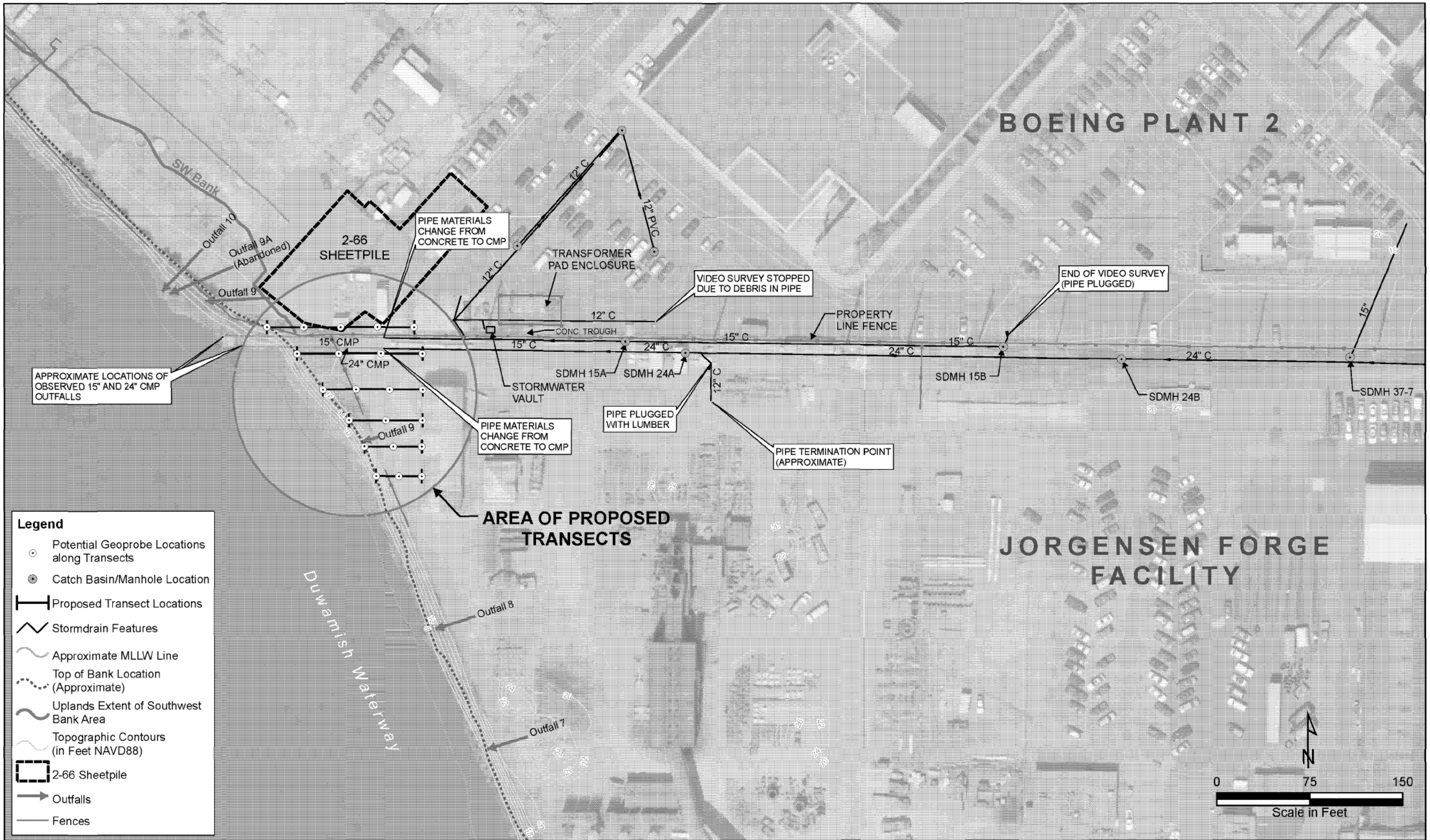
15-inch and 24-inch Pipes Cleanout Work Plan
Jorgensen Forge Outfall Site
Source Control Action
Seattle, Washington

Figure 3
Site Plan

DWG NAME: G:\project\Clients\Floyd and Snider\boeing\Plant 2 CAD 2010\boeing2010_003.dwg
DATE: 11/3/2010 2:36 PM



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15-inch and 24-inch Pipes Cleanout Work Plan
Jorgensen Forge Outfall Site
Source Control Action
Seattle, Washington

Figure 4
Corrugated Metal Pipe Investigation
Transect Alignments and
Proposed Boring Locations

F:\projects\Boeing Plant 2 - 2010\GIS\MXD\JorgensenForge\Figure 4(CMP Investigation Transects and Proposed Boring Locations).mxd
Date: 11/4/2010 9:20 AM

Jorgensen Forge Outfall Site
Seattle, Washington

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15-inch and 24-inch Pipes Cleanout Work Plan

Appendix A
Reference Figures and Tables

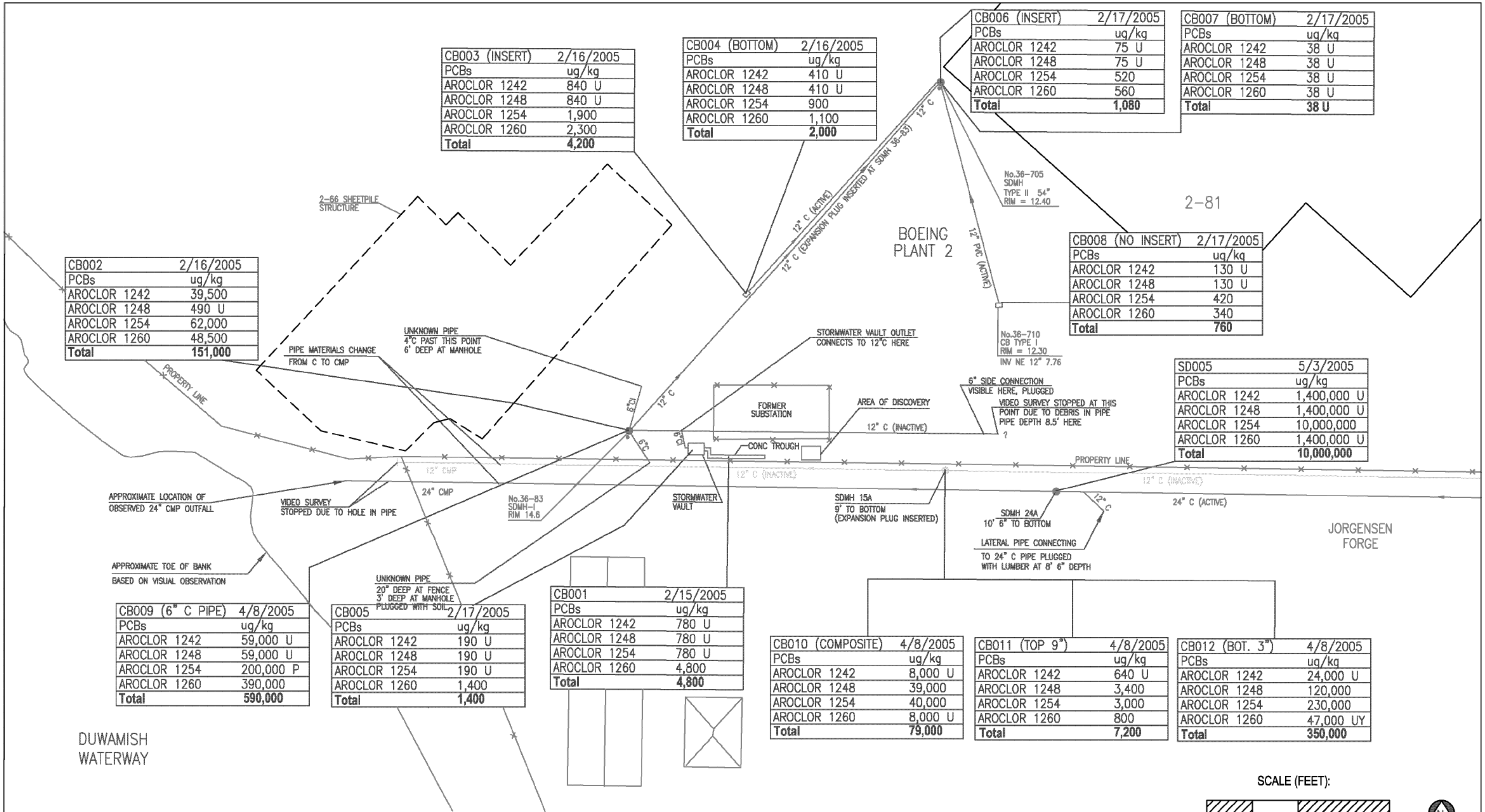
FINAL

Floyd Snider McCarthy, Inc.

BOEING

Phase 1 Transformer PCB Investigation Report
Boeing Plant 2
Seattle, Washington

Photo A.1
Photo Taken on 12/13/01 Showing Area of
Discovery Excavation Looking Towards River



CB002	2/16/2005
PCBs	ug/kg
AROCLOR 1242	39,500
AROCLOR 1248	490 U
AROCLOR 1254	62,000
AROCLOR 1260	48,500
Total	**151,000**

CB003 (INSERT)	2/16/2005
PCBs	ug/kg
AROCLOR 1242	840 U
AROCLOR 1248	840 U
AROCLOR 1254	1,900
AROCLOR 1260	2,300
Total	**4,200**

CB004 (BOTTOM)	2/16/2005
PCBs	ug/kg
AROCLOR 1242	410 U
AROCLOR 1248	410 U
AROCLOR 1254	900
AROCLOR 1260	1,100
Total	**2,000**

CB006 (INSERT)	2/17/2005
PCBs	ug/kg
AROCLOR 1242	75 U
AROCLOR 1248	75 U
AROCLOR 1254	520
AROCLOR 1260	560
Total	**1,080**

CB007 (BOTTOM)	2/17/2005
PCBs	ug/kg
AROCLOR 1242	38 U
AROCLOR 1248	38 U
AROCLOR 1254	38 U
AROCLOR 1260	38 U
Total	**38 U**

CB008 (NO INSERT)	2/17/2005
PCBs	ug/kg
AROCLOR 1242	130 U
AROCLOR 1248	130 U
AROCLOR 1254	420
AROCLOR 1260	340
Total	**760**

SD005	5/3/2005
PCBs	ug/kg
AROCLOR 1242	1,400,000 U
AROCLOR 1248	1,400,000 U
AROCLOR 1254	10,000,000
AROCLOR 1260	1,400,000 U
Total	**10,000,000**

CB009 (6" C PIPE)	4/8/2005
PCBs	ug/kg
AROCLOR 1242	59,000 U
AROCLOR 1248	59,000 U
AROCLOR 1254	200,000 P
AROCLOR 1260	390,000
Total	**590,000**

CB005	2/17/2005
PCBs	ug/kg
AROCLOR 1242	190 U
AROCLOR 1248	190 U
AROCLOR 1254	190 U
AROCLOR 1260	1,400
Total	**1,400**

CB001	2/15/2005
PCBs	ug/kg
AROCLOR 1242	780 U
AROCLOR 1248	780 U
AROCLOR 1254	780 U
AROCLOR 1260	4,800
Total	**4,800**

CB010 (COMPOSITE)	4/8/2005
PCBs	ug/kg
AROCLOR 1242	8,000 U
AROCLOR 1248	39,000
AROCLOR 1254	40,000
AROCLOR 1260	8,000 U
Total	**79,000**

CB011 (TOP 9")	4/8/2005
PCBs	ug/kg
AROCLOR 1242	640 U
AROCLOR 1248	3,400
AROCLOR 1254	3,000
AROCLOR 1260	800
Total	**7,200**

CB012 (BOT. 3")	4/8/2005
PCBs	ug/kg
AROCLOR 1242	24,000 U
AROCLOR 1248	120,000
AROCLOR 1254	230,000
AROCLOR 1260	47,000 UY
Total	**350,000**

NOTES:
1) PIPES SHOWN IN COLOR WERE INVESTIGATED USING A VIDEO CAMERA OR SNAKE/SONDE EQUIPMENT.

NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION

PHASE II TRANSFORMER PCB INVESTIGATION
BOEING PLANT 2
SEATTLE, WASHINGTON

WESTON SOLUTIONS
SEATTLE WASHINGTON

CHECKED / DATE
DES. ENG.
PROJ. ENG.
PROJ. MGR.
APPROVED
APPROVED

EXPLANATION OF DRAWING SYMBOLS
-x-x- CHAIN LINK FENCE
● MANHOLE (COLOR VARIES)
C CONCRETE
CMP CORRUGATED METAL PIPE
PVC POLY VINYL CHLORIDE
CI CAST IRON
→ STORMWATER FLOW DIRECTION
U NOT DETECTED ABOVE GIVEN DETECTION LIMIT
Y DETECTION LIMIT ELEVATED DUE TO INTERFERENCES
P POSITIVELY IDENTIFIED BUT WITH RPD > 40%
CB001 SAMPLE IDENTIFER
2/15/2005 SAMPLE DATE

FIGURE 3.7
STORM SURVEY DETAILS AND PCB AROCLOR CONCENTRATIONS IN STORM SYSTEM SOLIDS SAMPLES

DRAWN DLD | DATE JULY 29, 2005 | DWG. NO. BP2-TPB | REV. NO. 0
SCALE 1" = 40' | W.O. NO. 03709-079-001-0004 | RFW NO. 05-0098 | SHT. 1 OF 1

B-DUW2-1128321

Table F.1
Storm Solids Sampling Results for Metals

Location	Sample ID	Location Description	Sample Date	Metals (mg/kg) Arsenic Value	Arsenic Q	Barium Value	Barium Q	Cadmium Value	Cadmium Q	Chromium Value	Chromium Q	Lead Value	Lead Q	Mercury Value	Mercury Q	Selenium Value	Selenium Q	Silver Value	Silver Q
CB010	P2ST-GR-CB010-0000	MH 15A along 12" storm pipe on JF: composite sample from top and bottom layers.	4/8/2005	0.2	U	0.38		0.01		0.02	U	0.2		0.0001	U	0.2	U	0.02	U
CB011	P2ST-GR-CB011-0000	MH 15A along 12" storm pipe on JF: sample from top 9" layer of slag/gravel atop sand layer at base of manhole.	4/8/2005	30	U	42		1	U	387		100		0.23		30	U	2	U
CB012	P2ST-GR-CB012-0000	MH 15A along 12" storm pipe on JF: sample from 3" sand layer at base of manhole.	4/8/2005	20		132		3.7		133		477		0.6		20	U	1	U

Notes:
U Indicates the compound was undetected at the reported concentration.

Table F.2
Storm Solids Sampling Results for SVOCs

Location	Sample ID	Location Description	Sample Date	Interval (inches below pile)		Semi-Volatile Organic Carbons (µg/kg)																					
						Benzo(a)anthracene		Benzo(a)pyrene		Benzo(b)fluoranthene		Benzo(k)fluoranthene		Chrysene		Dibenz(a,h)anthracene		Fluoranthene		Fluorene		Indeno(1,2,3-cd)pyrene		Naphthalene		Pyrene	
				Upper Limit	Lower Limit	Value	Q	Value	Q	Value	Q	Value	Q	Value	Q	Value	Q	Value	Q	Value	Q	Value	Q	Value	Q	Value	Q
CB009	P2ST-GR-CB009-0000	6-inch pipe into MH 36-83.	4/8/2005	0	1	280	U	280	U	280	U	280	U	280	U	280	U	280	U	280	U	280	U	280	U	280	U
CB010	P2ST-GR-CB010-0000	MH 15A along 12" storm pipe on JF: composite sample from top and bottom layers.	4/8/2005	0	12	64	U	64	U	64	U	64	U	64	U	64	U	64	U	64	U	64	U	64	U	64	U
CB011	P2ST-GR-CB011-0000	MH 15A along 12" storm pipe on JF: sample from top 9" layer of slag/gravel atop sand layer at base of manhole.	4/8/2005	0	9	64	U	64	U	64	U	64	U	64	U	64	U	64	U	64	U	64	U	64	U	64	U
CB012	P2ST-GR-CB012-0000	MH 15A along 12" storm pipe on JF: sample from 3" sand layer at base of manhole.	4/8/2005	9	12	130		98		95		130		160		66	U	250		66	U	92		66	U	230	

Notes:

U Indicates the compound was undetected at the reported concentration.

MH Manhole.

Jorgensen Forge Outfall Site
Seattle, Washington

Source Control Action

15-inch and 24-inch Pipes Cleanout Work Plan

Appendix B
Sampling and Analysis Plan/ Quality Assurance Project Plan

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List of Abbreviations and Acronyms

Abbreviation/ Acronym	Definition
ARI	Analytical Resources, Inc.
CMP	Corrugated Metal Pipe
COC	Constituent of concern
DQO	Data quality objective
Ecology	Washington State Department of Ecology
EDD	Electronic data deliverable
HDPE	High density polyurethane
IDW	Investigation-derived waste
LDW	Lower Duwamish Waterway
MS/MSD	Matrix spike/matrix spike duplicate
PCB	Polychlorinated biphenyl
Pipes	15-inch and 24-inch Property Line Storm Pipes
QA/QC	Quality assurance/quality control
RPD	Relative percent difference
SAP/QAPP	Sampling and Analysis Plan and Quality Assurance Project Plan
Site	Jorgensen Forge Corporation Property
USEPA	U.S. Environmental Protection Agency

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1.0 Project Description

This Sampling and Analysis Plan and Quality Assurance Project Plan (SAP/QAPP) presents the organization, objectives, planned activities, and specific quality assurance/quality control (QA/QC) procedures associated with the proposed activities to be conducted as part of the cleanout and sealing procedures detailed in the 15-inch and 24-inch Property Line Storm Pipes Cleanup Work Plan (Work Plan). The work will be conducted on the Jorgensen Forge Corporation Property at 8531 East Marginal Way South in Seattle, Washington (Site; Figure 1 of Work Plan). The SAP/QAPP was developed in adherence to the quality system elements presented in the Project-specific Quality Management Plan (Attachment B.1) necessary to meet the QA/QC requirements for the project.

This SAP/QAPP provides guidance to field, project, and laboratory personnel involved in the cleanout and closure of the 15-inch and 24-inch Property Line Storm Pipes (collectively, Pipes) to ensure that data quality is maintained. Any future changes to the Work Plan (such as changes in sampling locations, sampling frequency, and/or chemical analyses) will be described in addenda to this SAP/QAPP.

Specific protocols for sampling, sample handling and storage, chain-of-custody, and laboratory and field analyses are described in this SAP/QAPP. This plan was developed in accordance with the Washington State Department of Ecology's (Ecology's) *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies* (Ecology 2004), the U.S. Environmental Protection Agency's *Requirements for Quality Assurance Project Plans* and *Guidance for Quality Assurance Project Plans* (USEPA 2001, 2002).

A copy of this SAP/QAPP and the Health and Safety Plan (HASP) should be carried in the field when completing the Work Plan activities.

1.1 PROJECT ACTIVITIES

Supporting information and rationale for the project activities is presented in the Work Plan. The project activities focus on the cleanout and sealing of the Pipes and investigating an area of a bank near the Lower Duwamish Waterway (LDW) traversed by the Pipes. The proposed activities include the following:

- Conducting a tidal elevation survey of the 24-inch Pipe prior to cleanout and closure.
- Sampling and chemical analysis of solids in the Pipes for source tracing.
- Cleaning and permanently sealing the Pipes and associated laterals to eliminate discharge to the LDW.
- Waste characterization of water and solids generated from the cleaning process.
- Investigating the nature and extent of contamination in the area of the bank traversed by the Corrugated Metal Pipe (CMP) segments of the Pipes.

1.2 PROJECT SCHEDULE

The proposed schedule is detailed in Section 5.0 of the Work Plan. The schedule for implementing the field activities is intended to be used as a guide. Adjustments to the implementation dates and the estimated project duration may be necessary to account for variable unforeseen or unavoidable conditions encountered in the field or the laboratory (e.g., inclement weather, difficulties in accessing a sampling site, or additional time needed to complete a task).

2.0 Project Organization and Responsibilities

Under the authorization of the USEPA Office of Emergency Response, Floyd|Snider is responsible to perform or oversee performance of field activities described in the Work Plan. Analytical Resources Inc. (ARI) in Tukwila, Washington will be the primary analytical laboratory, performing all chemical analyses on samples that are collected and submitted during the investigation.

The various quality assurance field, laboratory, and management responsibilities of key project personnel are defined below. This SAP/QAPP will be distributed to all key project personnel.

2.1 PROJECT/TASK ORGANIZATION—MANAGEMENT RESPONSIBILITES

2.1.1 Mike Sibley—USEPA Office of Emergency Response

Mike Sibley is the USEPA point of contact and control for matters concerning the project.

2.1.2 Nick Garson—Boeing Project Coordinator

Nick Garson is The Boeing Company's (Boeing's) point of contact concerning the project.

2.1.3 Thomas Colligan—Floyd|Snider Project Manager

Thomas Colligan will have overall responsibility for project implementation. As Project Manager, he will be responsible for the overall quality assurance on this project to ensure that it meets technical and contractual requirements. The Floyd|Snider Project Manager will report to the Boeing Project Coordinator and is responsible for technical QC and project oversight.

The Floyd|Snider Project Manager will perform the following:

- Communicate with Boeing and USEPA.
- Monitor project activity and quality.
- Provide overview of field activities to Boeing.
- Review and approve planning and reporting of investigation activities.
- Provide technical representation of project activities.

2.1.4 Lisa Meoli—Floyd|Snider Field Manager

Lisa Meoli will have overall responsibility for project implementation. As Field Manager, she will be responsible for leading and coordinating the day-to-day activities in the field. The Field Manager will report directly to the Floyd|Snider Project Manager and QA Manager.

The specific responsibilities for the Field Manager include:

- Day-to-day coordination with the Floyd|Snider Project Manager.

- Adhere to work schedule.
- Review technical data provided by the field staff, including field measurement data.
- Coordinate and oversee subcontractors. Identify problems, resolve difficulties in consultation with the Floyd|Snider Project Manager and QA Manager, implement and document corrective action procedures, and communicate between team and upper management.
- Prepare summary reports.

2.2 QUALITY ASSURANCE RESPONSIBILITIES

2.2.1 Jessi Massingale—Floyd|Snider QA Manager

The Floyd|Snider QA Manager provides direction to the Floyd|Snider Field Manager and reports to the Project Manager. The QA Manager is responsible for ensuring that all QA/QC procedures for this project are being followed. Additional responsibilities include the following:

- Overview and review of field QA/QC.
- Coordinate supply of performance evaluation samples and review results from performance audits.
- Review laboratory QA/QC.
- Advise on data corrective action procedures.
- Review data validation reports.
- QA/QC representation of project activities.
- Approve the SAP/QAPP.

2.3 LABORATORY RESPONSIBILITIES

ARI will perform all chemical analytical services in support of the Work Plan activities. The lab will be contacted prior to initiation of Work Plan activities to ensure appropriate sample storage and handing as well as to ensure that the appropriate analytical methods and procedures are performed. A copy of the QAPP should be provided to the lab prior to collection and transfer of samples to the laboratory. Any deviation from the requirements specified in the QAPP by the laboratory need to be approved by the Floyd|Snider Project Manager and QA Manager.

2.3.1 Kelly Bottem—ARI Project Manager

The ARI Project Manager will report directly to the Floyd|Snider Project Manager and the Floyd|Snider QA Manager and will be responsible for the following:

- Ensuring that all resources of the laboratory are available.
- Advising Floyd|Snider's Project Manager and QA Manager of laboratory status.
- Coordinating internal laboratory analyses.

- Supervising laboratory procedures.
- Reviewing and approving final analytical reports.

2.4 SPECIAL TRAINING/CERTIFICATIONS

All field personnel for this project are required to have Hazardous Waste Operations and Emergency Response (HAZWOPER) 40-hour, basic First Aid and Cardio Pulmonary Resuscitation (CPR) training.

2.5 DOCUMENTATION AND RECORDS

All original project documents will be kept by Floyd|Snider and following project completion will be archived for a 10-year period following USEPA's completion of work notice. Documents may be retained in electronic rather than paper form.

A current copy of the Work Plan, SAP/QAPP, and HASP will be provided by the Floyd|Snider Field Manager to all field personnel in advance of field activity.

At the end of each field day, all field documents will be downloaded and/or scanned to the electronic project files maintained by Floyd|Snider including, but not limited to:

- field photographs,
- sample collection forms,
- boring logs,
- Chain-of-Custody Forms, and
- signed health and safety tailgate meeting sheet.

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3.0 Sampling Procedures

Sample collection and analysis is summarized in Table B.1. Specific requirements for each sample medium are described below.

3.1 TIDAL SURVEY

Prior to cleanout work, a tidal survey will be performed by placing pressure transducers in each of the five accessible catch basins in the 24-inch Pipe between the outfall and East Marginal Way. The catch basins are shown on Figure 3 of the Work Plan. The transducers will be placed at the bottom of each catch basin and in one stilling well in the LDW. Each transducer will be set to record water pressure, temperature, and conductivity every 5 minutes over a 2-week period. Surveyed elevations of manhole covers and the bottom of the basins will be used to translate the pressure readings into water elevation. A barometer will be hung above the water in one catch basin to allow for barometric pressure correction.

3.2 SURFACE WATER SAMPLING

A water sample will be collected from each catch basin along the 24-inch Pipe prior to commencement of cleanout and sealing activities. Depending on access constraints and the depth of water, the sample will be collected by using a peristaltic pump or by using a swing sampler.

As part of sample collection, the following information will be recorded on the sample collection form (Attachment B.2):

- Date, time, and name of the person collecting the sample
- Sample number and location
- Method of collection
- Sample description
- Presence of sheen, odor, or any other indications of contamination

3.3 SOLIDS SAMPLING

Samples will be collected of the solid material accumulated on the walls of the pipes accessible from each storm drain manhole and the interior of the accessible laterals at each opening created for sealing and cleanout access.

Additional samples of solids from the interior of the Pipes, accessible laterals, and from excavated material may be collected at the discretion of the field technician based on field observations and accessibility. This may include collecting samples within or associated with other nearby storm drains or outfalls, including Jorgensen Outfall 9 and the 6-inch lateral pipe that enters from the Jorgensen Property into Boeing Storm Drain 36-83, near the former Seattle City Light (SCL) transformer pad.

Samples may be collected by the field technician or by the contractor and transferred to the field technician. Solid material should be collected from the side walls or top of the pipes only. An attempt will be made to collect a volume of solid material sufficient to fill the sample container. Samples will be photographed and visually described using United Soil Classification System (USCS) soil descriptors to the extent possible.

As part of sample collection, the following information will be recorded in a bound field notebook:

- Date, time, and name of the person logging the sample
- Sample number and location
- Sample description
- Presence of debris
- Presence of sheen, odor, or any other indications of contamination

3.4 SUBSURFACE SOIL SAMPLING

Three to five soil borings will be advanced using direct-push technology (e.g., Geoprobe™) along up to five transects parallel to the CMP portions of the Pipes. This area is indicated on Figure 4 of the Work Plan. Soil boring will commence in the northernmost transect and proceed south. The southernmost transects will be probed only if fill and/or debris is noted at the previous adjacent transect.

All borings will be monitored and recorded by a field technician on soil boring log forms (Attachment B.2). The borings will be advanced by Geoprobe™ to allow continuous soil collection, which is typically retrieved in 4- or 5-foot sampling tubes. Three discrete soil samples will be collected from each boring at depths targeting the midway point between land surface and top of the CMP sections (approximately 3 to 5 feet below ground surface [bgs]), a point directly below the CMP sections (approximately 10 to 12 feet bgs) and a point approximately 2 feet below native soil contact. Soil cores and samples will be described and classified according to the Unified Soil Classification System (USCS) and photographed. Remaining soil cores will be managed as investigation-derived waste (IDW) as detailed in Section 3.8.

As part of sample collection, the following information will be recorded on the soil sample collection form, or boring log:

- Date, time, and name of the person logging the sample
- Sample number and location
- Sample depth and description
- Sample recovery
- Presence of debris
- Presence of sheen, odor, or any other indications of contamination

3.5 GROUNDWATER SAMPLING

Groundwater encountered in the three easternmost borings along the northern three transects will be sampled. The sample will be collected from a retractable screen sampler using clean, disposable polyethylene tubing and a peristaltic pump. Enough water will be purged to remove the highly turbid water containing sand that is initially extracted and may quickly clog a 0.45 µm field filter; this volume is typically less than 1 gallon. Purge water will be collected in buckets and managed according to the procedures for IDW in Section 3.8.

Retractable screen groundwater samples will field-filtered, using a 0.45 µm filter, into appropriately preserved containers for PCB analysis and unfiltered for volatile organic compound (VOC) analysis. Field duplicate and equipment rinsate blanks will be collected during retractable screen groundwater sampling as described in Section 3.6.

As part of sample collection, the following information will be recorded on the groundwater sample collection form (Attachment B.2):

- Date, time, and name of the person logging the sample
- Sample number and boring location
- Sample description
- Total purged volume
- Presence of sheen, odor, or any other indications of contamination

3.6 QUALITY CONTROL SAMPLES

3.6.1 Field Duplicate Samples

Field duplicate samples will be collected from groundwater sample locations. Field duplicates will be collected at a frequency of approximately 5 percent or a fraction thereof of the total number of groundwater sample locations per sampling event, exclusive of other QC samples. Field duplicate samples will be collected under conditions as identical as reasonably possible to the original sample.

3.6.2 Field Equipment Rinsate Blank Samples

Equipment rinsate blank samples will be obtained at a frequency of 5 percent during solids sampling (described in Section 3.1) and groundwater sampling. Rinsate blanks will consist of deionized water passed over and/or through decontaminated sampling equipment. Equipment rinsate blank samples will be collected for groundwater only when a retractable screen groundwater sampler is used. Any other groundwater sample collection method should be done using disposable equipment.

3.6.3 Trip Blanks

Trip blanks will be included in each cooler and samples will be analyzed for VOCs to ensure that the sample containers do not contribute to any detected analyte concentrations and to identify any artifacts of improper sample handling, storage, or shipping.

3.7 SAMPLING AND DRILLING EQUIPMENT DECONTAMINATION PROCEDURES

All non-drilling sampling equipment will be decontaminated prior to initiating sampling activities, between sampling locations, and following completion of sampling activities. Field sampling equipment will be decontaminated by washing with Alconox (or equivalent) and tap water rinse, and final rinsing with deionized water. Each piece of equipment (i.e., stainless steel bowl, trowel, etc.) will be decontaminated. For water level indicator probes, the probe and deployed cable will be decontaminated.

Drilling equipment that directly contacts soil or groundwater samples (i.e., drilling rods, retractable screen groundwater samplers, etc.) will be decontaminated by steam cleaning prior to the start of drilling at the Site and decontaminated following completion of each boring by washing with Alconox (or equivalent) and rinsing with potable water. Equipment needed to decontaminate drilling equipment will be provided by the drilling subcontractor and will be determined prior to mobilization to the field.

3.8 INVESTIGATION-DERIVED WASTE HANDLING AND DISPOSAL

Waste derived during all field activities will be managed and disposed of in accordance with applicable waste management regulations. IDW includes the following liquids and solids:

- Water collected during pipe cleaning
- Storage tank sludge
- Soil drill cuttings, including non-soil debris that may be removed from the subsurface during drilling
- Purge water
- Decontamination wash and rinse water
- Soil and groundwater samples not submitted to a laboratory for analysis
- Disposable materials used during field work that are impacted by contaminated surface water, groundwater, or decontamination wash water (e.g., disposable PPE, used filters, plastic sheeting, paper towels, etc.)

Waste produced during field activities will be assumed to be contaminated and will be containerized and temporarily stored on-site. When available, analytical results from samples will be used to characterize the waste; otherwise characterization samples will be collected from the container for waste characterization. As appropriate, waste will be treated on-site as permitted sanitary sewer discharge (e.g., purge water) or disposed of off-site at a licensed disposal facility. Per Section VIII, Para 21 of the Order, prior to any shipment of waste from the Site to an out-of-state management facility that totals 10 cubic yards or more, Boeing will provide written notification of such shipment to the appropriate state environmental official in the receiving facility's state and to the USEPA On-Scene Coordinator. Also, before shipping any hazardous substances off-site, Boeing shall obtain USEPA's certification that the proposed receiving facility is operating in compliance with the requirements of CERCLA Section 121(d)((3) and 40 CFR 300.440.

The subsurface investigation may produce concrete and asphalt surface pavement cuttings; if generated, these will be left on-site in the same boring/cutting location, and not treated as IDW.

Disposable materials generated during field work will be combined with containerized soil for off-site disposal when impacted by waste, contaminated groundwater, or decontamination wash water. Disposable materials that have not contacted waste, contaminated soil, or contaminated groundwater, or do not contain significant volumes of contaminant (e.g., Nitrile gloves, empty tubing) may be disposed of as conventional refuse at the discretion of the field personnel.

3.9 LOCATION CONTROL

Sample location information will be collected to meet Ecology's Environmental Information Management (EIM) system data submission requirements, in addition to rendering locations on figures or revisiting soil boring locations. Locations of water and solids samples collected during the pipe cleaning work will be surveyed by field personnel using a sub-meter Global Positioning System (GPS) unit and tracked by recording the distance in feet from the nearest manhole or similar landmark shown on Figure 3 of the Work Plan. A licensed professional surveyor will survey the transducer locations used in the tidal survey and the soil boring locations drilled during the CMP investigation. Locations may be surveyed during investigation, prior to decommissioning a boring location, or at the completion of the field event.

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4.0 Sample Handling and Custody Documentation

Sample possession and handling must be traceable from the time of sample collection, through laboratory and data analysis, to the time sample results are reported. A sample log form and field logbook entries will be completed for each location and each sample collected.

4.1 SAMPLE HANDLING

To control the integrity of the samples during transit to the laboratory and prior to analysis, established preservation and storage measures will be taken. Sample containers will be labeled with the client name, project number, sample number, sampling date and time, required analyses, and initials of the individual that collected the sample. The Field Manager will check all container labels, custody form entries, and logbook entries for completeness and accuracy at the end of each sampling day.

4.2 SAMPLE NOMENCLATURE

All samples collected for this project will be labeled with a unique identification code. Identification of water or solids samples collected from the catch basins, Pipes, or associated laterals will be in the following format: location – type – media – number. Soil and groundwater samples collected from boreholes will be labeled in the following format: location – boring – media – depth. Other information to be documented on each the bottle label includes the date, time, analyses, and initials of sampler. Identification codes and definitions for each sample type are as follows:

Catch Basins and Pipes

Location: JF (Jorgensen Forge)
Type: PLSD (Property Line Storm Drain)
Media: SW (surface water), PS (pipe solids)
Number: 01 through 99 (two digits)

Example Label: JF-PLSD-PS-03
The third sample of solid material from a property line storm drain pipe on Jorgensen Forge Property.

Soil Borings

Location: JF (Jorgensen Forge)
Type: TxBx (transect and boring [x])
Media: SO (soil), GW (groundwater)
Depth: 01 through 99 feet bgs (two digits)

Example Label: JF-T2B4-SO-08
A soil sample collected at 8 feet bgs in the fourth boring along the second transect line on Jorgensen Forge Property.
JF-T2B4-GW-08
A groundwater sample collected from the same boring and depth.

Field Quality Control

Duplicate	D
Example Label:	JF-PLSD-PS-03-D, duplicate sample of pipe solids material sample identified above.
Equipment Rinsate	R
Example Label:	JF-T2B4-GW-08–R, rinsate sample from groundwater sample identified above.

4.3 SAMPLE CHAIN-OF-CUSTODY

Chain-of-custody procedures will be strictly followed to provide an accurate written record of the possession of each sample from the time it is collected in the field through laboratory analysis. Adequate sample custody will be achieved by means of approved field and analytical documentation. Such documentation includes the Chain-of-Custody Form, which is initially completed by the sampler and is thereafter signed by those individuals who accept custody of the sample. A sample will be considered to be in custody if it is:

- in someone's physical possession,
- in someone's view,
- secured in a locked container or vehicle or otherwise sealed so that any tampering would be evident, or
- kept in a secured area, restricted to authorized personnel only.

The laboratory will provide sufficient copies of blank Chain-of-Custody Forms. All sample information (i.e., sample date/time, sample matrix, number of containers, etc.), including all required analyses, will be logged onto a Chain-of-Custody Form prior to formal transfer of sample containers to the analytical laboratory. Whenever possession of the samples is transferred, the individuals relinquishing and receiving the samples will respectively sign, date, and note the time of transfer on the Chain-of-Custody Form. This form documents the transfer of custody of samples from the sampler to the laboratory.

The person responsible for transfer/transport of the samples to the laboratory will complete and sign the Chain-of-Custody Form, keeping a copy for future reference. The sampler will place the original form in a clear zip-lock bag inside the sample cooler with the samples. One Chain-of-Custody Form will be completed and placed inside each individual cooler.

4.4 SAMPLE PRESERVATION

Table B.2 summarizes sample size requirements, container type, preservation method, and holding times for analytes. Samples requiring field preservation will be placed into pre-preserved sample containers supplied by the laboratory. Immediately after the sample jars are filled, they will be placed in the appropriate cooler with a sufficient number of ice packs (or crushed ice) to keep them cool through transport to the laboratory. All samples will be preserved by keeping cool to 6°C. Following analysis, remaining samples may be preserved by freezing.

4.5 SAMPLE TRANSPORT AND SHIPMENT

Technical field staff will be responsible for sample tracking and custody procedures in the field. The Field Manager will be responsible for final sample inventory and will maintain sample custody documentation. At the end of each day, and prior to transfer, custody form entries will be made for all samples. Each sample cooler will be accompanied by a Chain-of-Custody Form. Copies of forms will be retained and included as appendices to QA/QC reports to management.

Prior to transport and/or shipping, sample containers will be wrapped and securely packed inside the cooler with ice packs or crushed ice by the field technician or designee. The original, signed custody forms will be transferred with the cooler. Samples will be delivered to the laboratory under custody following completion of sampling activities on a daily basis, or at maximum every other day.

4.6 SAMPLE RECEIPT

The designated sample custodian at the laboratory will accept custody of the samples and verify that the Chain-of-Custody Form matches the samples received. The ARI Project Manager will ensure that the custody forms are properly signed upon receipt of the samples and will note questions or observations concerning sample integrity on the custody forms. The laboratory will contact the Field Manager immediately if discrepancies are discovered between the custody forms and the sample shipment upon receipt. The ARI Project Manager, or designee, will specifically note any coolers that do meet sample preservation requirements.

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5.0 Quality Assurance Objectives

5.1 LABORATORY ANALYSIS PROGRAM

5.1.1 Contract Laboratory Requirements

In completing chemical analyses for this project, the contract laboratory is expected to meet the following minimum requirements:

1. Adhere to the methods outlined in the QAPP, including methods referenced for each analytical procedure.
2. Deliver fax, hard copy, and electronic data as specified.
3. Meet reporting requirements for deliverables.
4. Meet turnaround times for deliverables.
5. Implement QA/QC procedures, including the QAPP data quality requirements, laboratory QA requirements, and performance evaluation testing requirements.
6. Allow laboratory and data audits to be performed, if deemed necessary.

5.1.2 Chemical Analyses

Samples will be analyzed for the constituent groups using the methods presented in Table B.2. All chemical analyses will be performed by ARI.

5.1.2.1 Reporting Limits

The analytical methods identified in this SAP/QAPP result in the lowest analytically achievable method detection limits and reporting limits or Practical Quantitation Limits (PQLs). Table B.2 presents the target reporting limits for each analytical method as performed by ARI. These reporting limits are goals only, insofar as instances may arise where high sample concentrations, non-homogeneity of samples, or matrix interferences preclude achieving the desired reporting limit and associated QC criteria. In such instances, the laboratory will report the reason for any deviation from these reporting limits.

5.1.2.2 Sample Archival

Remaining sample volumes will be archived in a laboratory freezer at a temperature range of -10 to -20 degrees Fahrenheit in the event that additional analysis is needed.

5.2 LABORATORY QUALITY ASSURANCE OBJECTIVE

This SAP/QAPP establishes QC procedures and QA criteria to meet the data quality objectives (DQOs) set forth for the field activities to be conducted at the Site. The overall QA objective is to specify laboratory procedures for ensuring that data quality is maintained for field sampling, chain of custody, laboratory analyses, and reporting.

5.2.1 Laboratory Data Quality Objectives

The DQOs for the work described in this SAP/QAPP are to obtain the type and quantity of data in a manner such that the data are of known, appropriate, and sufficient quality to support the intended use. Analytical DQOs include obtaining data that are technically sound and properly documented, having been evaluated against established criteria for the principle data quality indicators (i.e., precision, accuracy, representativeness, completeness, and comparability) as defined in Ecology and USEPA guidance (Ecology 2004 and USEPA 1998).

5.2.1.1 Precision

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, precision is a quantitative measure of the variability of a group of measurements compared to their average values. Analytical precision is measured through matrix spike/matrix spike duplicate (MS/MSD) samples for organic analysis and through laboratory duplicate samples for inorganic analyses.

Analytical precision measurements will be carried out on project-specific samples at a minimum frequency of 1 per laboratory analysis group or 1 in 20 samples, whichever is more frequent per matrix analyzed, as practical. Laboratory precision will be evaluated against quantitative relative percent difference (RPD) performance criteria.

Field precision will be evaluated by the collection of blind field duplicates at a minimum frequency of 1 per laboratory analysis group or 1 in 20 samples; however, no data will be qualified based solely on field duplicate precision.

Precision measurements can be affected by the nearness of a chemical concentration to the method detection limit, where the percent error (expressed as RPD) increases. The equation used to express precision is as follows:

$$\mathrm{RPD} = \frac{(C_1 - C_2) \times 100\%}{\frac{(C_1 + C_2)}{2}}$$

Where:

RPD = relative percent difference
C_1 = larger of the two observed values
C2 = smaller of the two observed values

5.2.1.2 Accuracy

Accuracy is an expression of the degree to which a measured or computed value represents the true value. Analytical accuracy may be assessed by analyzing "spiked" samples with known standards (surrogates, laboratory control samples, and/or matrix spike) and measuring the percent recovery. Accuracy measurements on matrix spike samples will be carried out at a minimum frequency of 1 in 20 samples per matrix analyzed. Because MS/MSDs measure the effects of potential matrix interferences of a specific matrix, the laboratory will perform MS/MSDs only on samples from this investigation and not from other projects. Surrogate recoveries will be determined for every sample analyzed for organics. The acceptable accuracy ranges for the analytes included in this investigation are presented in Table B.3. Should the percent recoveries be outside the acceptable range, using professional judgment, data may be J-flagged as estimated concentrations.

Laboratory accuracy will be evaluated against quantitative laboratory control sample, matrix spike, and surrogate spike recoveries using limits for each applicable analyte. Accuracy can be expressed as a percentage of the true or reference value, or as a percent recovery in those analyses where reference materials are not available and spiked samples are analyzed. The equation used to express accuracy is as follows:

$$\%R = 100\% \times \frac{(S-U)}{C_{sa}}$$ %R = 100% x (S-U)/C

Where:

%R = percent recovery
S = measured concentration in the spiked aliquot
U = measured concentration in the unspiked aliquot
C_{sa} = actual concentration of spike added

5.2.1.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Care will be taken in the design of the sampling program to ensure that sample locations are selected properly, sufficient numbers of samples are collected to accurately reflect conditions at the location(s), and samples are representative of the sampling location(s). A sufficient volume of sample will be collected at each sampling location to minimize bias or errors associated with sample particle size and heterogeneity.

Selected analytes were identified as constituents of concern (COCs) based on previous sampling investigations.

5.2.1.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another. Comparability of the data will be maintained by following applicable protocols. The use of standard techniques for both sample collection and laboratory analysis should make the collected data comparable to both internal and other data generated. Comparability with previously generated data will be assessed as part of the work. Selected analytes were identified as COCs based on previous sampling investigations.

5.2.1.5 Completeness

Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected. Completeness will be calculated as follows:

$$C = \frac{(Number\ of\ acceptable\ data\ points) \times 100}{(Total\ number\ of\ data\ points)}$$

The DQO for completeness for all components of this project is 95 percent. Data that were qualified as estimated because the QC criteria were not met will be considered valid for the purpose of assessing completeness. Data that were qualified as rejected will not be considered valid for the purpose of assessing completeness.

5.3 QUALITY CONTROL PROCEDURES

Sampling procedures for this investigation are described in detail in Section 3.0. The following sections discuss the field and laboratory quality control procedures that will be followed for this investigation.

5.3.1 Field Quality Control Procedures

A rinsate blank QC sample will be collected during the sampling event on the non-dedicated field equipment (i.e., stainless steel bowl, trowel, and retractable screen, etc.) to ensure that field decontamination procedures are effective. All field QC samples will be documented in the field logbook and verified by the QA Manager or designee. A field duplicate will be collected at a frequency of 1 in 20 samples to evaluate the efficiency of field decontamination procedures, variability from sample handling, and site heterogeneity.

5.3.2 Laboratory Quality Control Procedures

Laboratory Quality Control Criteria. Results of the QC samples from each sample group will be reviewed by the analyst immediately after a sample group has been analyzed. The QC sample results will then be evaluated to determine whether control limits were exceeded. If control limits are exceeded in the sample group, corrective action (e.g., method modifications followed by reprocessing the affected samples) will be initiated prior to processing a subsequent group of samples.

All primary chemical standards and standard solutions used in this project will be traceable to documented and reliable commercial sources. Standards will be validated to determine their accuracy by comparison with an independent standard. Any impurities identified in the standard will be documented.

The following paragraphs summarize the procedures that will be used to assess data quality throughout sample analysis.

Laboratory Duplicates. Analytical duplicates provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Analytical duplicates are subsamples of the original sample that are prepared and analyzed as a separate sample. A minimum of 1 duplicate will be analyzed per sample group or for every 20 samples, whichever is more frequent.

Matrix Spikes and Matrix Spike Duplicates. Analysis of MS samples provides information on the extraction efficiency of the method on the sample matrix. By performing MSD analyses, information on the precision of the method is also provided for organic analyses. A minimum of 1 MS/MSD will be analyzed for every sample group or for every 20 samples, whichever is more frequent.

Laboratory Control Samples. A laboratory control sample (LCS) is a method blank sample carried throughout the same process as the samples to be analyzed, with a known amount of standard added. The blank spike compound recovery assesses analytical accuracy in the absence of any sample heterogeneity or matrix effects.

Surrogate Spikes. All project samples analyzed for organic compounds will be spiked with appropriate surrogate compounds as defined in the analytical methods. Surrogate recoveries will be reported by the laboratories; however, no sample result will be corrected for recovery using these values.

Method Blanks. Method blanks are analyzed to assess possible laboratory contamination at all stages of sample preparation and analysis. A minimum of 1 method blank will be analyzed for every extraction batch or for every 20 samples, whichever is more frequent.

5.4 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

Field equipment will be inspected and calibrated, following instrument manufacturers' directions, by the Project Field Lead prior to any use on the project.

5.5 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

Initial and continuing calibration will be performed in accordance with each analytical method requirement. Multipoint initial calibration will be performed on each instrument at the start of the project, after each major interruption to the analytical instrument, and when any ongoing calibration does not meet control criteria. Ongoing calibration will be performed daily for metals and organic analyses and with every sample batch for conventional parameters (when applicable) to track instrument performance.

Instrument blanks or continuing calibration blanks provide information on the stability of the baseline established. Continuing calibration blanks will be analyzed immediately following continuing calibration verification at a frequency of 1 continuing calibration blank for every 10 samples analyzed at the instrument for inorganic analyses and every 12 hours for organic analyses. If the ongoing calibration is out of control, the analysis must come to a halt until the source of the control failure is eliminated or reduced to meet control specifications. All project samples analyzed while instrument calibration was out of control will be reanalyzed.

5.6 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

There are no "critical" project supplies and consumables that may directly or indirectly affect the quality of the data results.

5.7 NON-DIRECT MEASUREMENTS

There are not any "non-direct measurement sources" that have been identified that will provide data to the project. All data will be directly measured and generated during project field activities.

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6.0 Data Reduction, Validation, and Management

Initial data reduction, evaluation, and reporting at the laboratory will be carried out as described in the appropriate analytical protocols and the laboratory's QA Manual. QC data resulting from methods and procedures described in this document will also be reported.

6.1 DATA REDUCTION AND LABORATORY REPORTING

The laboratory will be responsible for internal checks on data reporting and will correct errors identified during the QA review. Close contact will be maintained with the laboratories to resolve any QC problems in a timely manner. The analytical laboratories will be required, where applicable, to report the following:

- **Project/Case Narrative.** This summary, in the form of a cover letter, will discuss problems, if any, encountered during any aspect of analysis. This summary should discuss, but not be limited to, QC, sample transport/shipment, sample storage, and analytical difficulties. Any problems encountered (actual or perceived) and their resolutions will be documented in as much detail as necessary.
- **Sample Identification Numbers (IDs).** Records will be produced that clearly match all blind duplicate QA samples with laboratory sample IDs.
- **Chain-of-Custody Forms.** Legible copies of the custody forms will be provided as part of the data package. This documentation will include the time of receipt and condition of each sample received by the laboratory. Additional internal tracking of sample custody by the laboratory will also be documented.
- **Sample Results**. The data package will summarize the results for each sample analyzed. The summary will include the following information when applicable:
  - Field sample identification code and the corresponding laboratory identification code:
    - Sample matrix.
    - Date of sample extraction.
    - Date and time of analysis.
    - Weight and/or volume used for analysis.
    - Final dilution volumes or concentration factor for the sample.
    - Percent moisture in solid samples.
    - Identification of the instrument used for analysis.
    - Method reporting and quantitation limits:
  - Analytical results reported with reporting units identified.
  - All data qualifiers and their definitions.
  - Electronic data deliverables (EDDs).
- **Quality Assurance/Quality Control Summaries.** This section will contain the results of all QA/QC procedures. Each QA/QC sample analysis will be documented with the same information required for the sample results (refer to above). No

recovery or blank corrections will be made by the laboratory. The required summaries are listed below; additional information may be requested.

- **Method Blank Analysis.** The method blank analyses associated with each sample and the concentration of all compounds of interest identified in these blanks will be reported.
- **Surrogate Spike Recovery.** All surrogate spike recovery data for organic compounds will be reported. The name and concentration of all compounds added, percent recoveries, and range of recoveries will be listed.
- **Matrix Spike Recovery.** All matrix spike recovery data for metals and organic compounds will be reported. The name and concentration of all compounds added, percent recoveries, and range of recoveries will be listed. The RPD for all duplicate analyses will be reported.
- **Matrix Duplicate.** The RPD for all matrix duplicate analyses will be reported.
- **Blind Duplicates.** Blind duplicates will be reported in the same format as any other sample. RPDs will be calculated for duplicate samples and evaluated as part of the data quality review.

6.2 DATA VALIDATION

Per Section VIII, Para 17 of the Order, all sampling and analysis performed pursuant to the Order shall conform to USEPA direction, approval, and guidance regarding sampling, QA/QC, data validation and chain-of-custody procedures. Laboratories used shall participate in a QA/QC program and has a documented quality system that complies with the appropriate USEPA guidance. Floyd|Snider will review the laboratory reports for internal consistency, transmittal errors, laboratory protocols, and for adherence to the DQOs as specified in this SAP/QAPP. Data validation of all analytical data will be performed by Floyd|Snider. A Level I Data Quality Review (Summary Validation) will be performed on the analytical data obtained from the cleanout of the Pipes and laterals.

A Level I Data Quality Review (Summary Validation) includes the following:

- Evaluation of package completeness.
- Verification that sample numbers and analyses match those requested on the Chain-of-Custody Form.
- Review of method-specified preservation and sample holding times.
- Verification that the required detection limits and reporting limits have been achieved.
- Verification that the field duplicates, MS/MSDs, and laboratory control samples were analyzed at the proper frequency.
- Verification of analytical precision and accuracy via replicate analysis and analyte recoveries.
- Verification that the surrogate compound analyses have been performed and meet QC criteria.

- Verification that the laboratory method blanks were free of contaminants.

A Level III Data Quality Review (Summary Validation) using an outside qualified vendor will be performed on the remaining analytical data collected during investigation of the CMP area. This includes subsurface soil and groundwater analytical data.

A Level III Data Quality Review (Summary Validation) includes all aspects of Level I Data Quality Review and additional review of instrument performance—initial calibration, continuing calibration, tuning, sensitivity, and degradation. Level III Data Quality Review will be performed by a qualified subcontractor. The summary report from the outside vendor will be reviewed and approved by the Floyd|Snider QA Manager.

Data validation will be based on the QC criteria as recommended in the methods identified in this SAP/QAPP and in the National Functional Guidelines for Organic and Inorganic Data Review (USEPA 2008 and 2004).

Data usability, conformance with the DQOs, and any deviations that may have affected the quality of the data, as well as the basis of application of qualifiers, will be included in the final reporting of the data. Any required corrective actions based on the evaluation of the analytical data will be determined by the ARI Project Manager and Data Validator in consultation with the Floyd|Snider QA Manager and may include qualification or rejection of the data.

6.3 DATA MANAGEMENT

Floyd|Snider owns and maintains a custom database to store and query environmental chemistry results. This database will be used during the Work Plan activities and data can be queried as needed. All collected field data will be entered into the database. Analytical laboratory data will be received in an EDD format suitable for import into the database. Both laboratory data qualifiers and external data validation qualifiers will be stored in the database. The database is managed and stored in a Structured Query Language (SQL) Server and subject to electronic backup every 2 hours.

Data will be mapped in ArcGIS v9.3 as needed. Furthermore, specialized queries may be written to aid in data analyses. Queried data will be tabulated in Excel spreadsheet format. Excel spreadsheets will be formatted to be compatible with export of data to comma separated values format. All numerical data such as coordinates, concentration values, distances, depths will be entered into the Excel spreadsheet as numbers.

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7.0 Laboratory Audits and Corrective Actions

Laboratory and field performance audits and corrective action procedures are described in this section.

7.1 LABORATORY AND FIELD PERFORMANCE AUDITS

Laboratory and field performance audits will consist of on-site reviews of quality assurance systems and equipment for sampling, calibration, and measurement. Laboratory audits will not be conducted as part of this study; however, all laboratory audit reports will be made available to the Project QA Manager upon request. The laboratory is required to have written procedures addressing internal QA/QC. The laboratory must ensure that personnel engaged in all sample logging and analyses tasks have appropriate training.

The laboratory will, as part of the audit process, provide for consultant's review, written details of any and all method modifications planned.

7.2 CORRECTIVE ACTIONS FOR FIELD SAMPLING

The Floyd|Snider Field Manager will be responsible for correcting field errors in sampling or documenting equipment malfunctions during the field sampling effort. The Floyd|Snider QA Manager will be responsible for resolving situations in the field that may result in non-compliance with this SAP/QAPP. All corrective measures will be immediately documented in the field logbook.

7.3 CORRECTIVE ACTIONS FOR LABORATORY ANALYSES

The laboratory is required to comply with their Standard Operating Procedures and the requirements of the USEPA analytical methods, as specified in this SAP/QAPP. The ARI Project Manager will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this SAP/QAPP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data.

If any QC sample exceeds the project-specified control limits, the analyst will identify and correct the anomaly before continuing with the sample analysis. The analyst will document the corrective action taken in a memorandum submitted to the Floyd|Snider QA Manager. A narrative describing the anomaly, the steps taken to identify and correct the anomaly, and the treatment of the relevant sample batch (i.e., recalculation, reanalysis, and/or re-extraction) will be submitted with the data package.

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8.0 Data Reporting

Following completion of field activities a summary report will be compiled and submitted to USEPA. The report will include the following:

- A description of the purpose and goals of the investigation.
- A summary of the field sampling and laboratory analytical procedures.
- A summary of subcontractor procedure and documentation of task completion.
- A general vicinity map showing the location of the Site and a sampling location map. Coordinates (i.e., latitude and longitude and state plan coordinates) for the sampling locations will be reported in an accompanying table.
- Data tables for all media summarizing the chemical and conventional analytical results, as well as pertinent QA/QC data. The data tables will include sample location numbers, sample IDs, dates of sample collection, depth of sample collection, and whether the sample was a duplicate or other QC sample.
- QA reports and laboratory data reports as appendices or attachments.
- Copies of photographs, field logs, sampling forms, and Chain-of-Custody Forms as appendices or attachments.
- A good faith estimate of the total costs or statement of actual costs incurred in complying with the Order.
- A listing of quantities and types of materials removed off-site or handled onsite.
- A discussion of removal and disposal options considered for those materials.
- A listing of the ultimate destinations of those materials.
- Accompanying appendices including all relevant documentation generated during the removal action (e.g., manifests, invoices, bills, contracts, and permits).The report will also include a certification signed by the Project Manager that the information provided in the report is true, accurate, and complete.

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9.0 References

U. S. Environmental Protection Agency (USEPA). 1998. *USEPA Guidance Document for Quality Assurance Project Plans.* Publication EPA QA/G-5, EPA/600/R-98/018.

_____. 2001. *Requirements for Quality Assurance Project Plans.* EPA QA/R-5. March.

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_____. 2004. *USEPA National Contract Laboratory Program National Functional Guidelines for Inorganic Data Review.* OSWER 9240.1-45, EPA 540-R-04-004. Office of Superfund Remediation and Technology Innovation (OSRTI), Washington, D.C. October.

_____. 2008. *USEPA Contract Laboratory Program, National Functional Guidelines for Organic Data Review.* EPA-540/R-99/008. October.

Washington State Department of Ecology (Ecology). 2004. *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies.* Publication No. 04-03-030. Revision of Publication No. 01-03-003. July.

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Seattle, Washington

Source Control Action

15-inch and 24-inch Pipes Cleanout Work Plan

Appendix B
Sampling and Analysis Plan/ Quality Assurance Project Plan

Tables

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Table B.1
Sample Collection and Analysis Summary

Task	Number of Samples[1]	Location	Sampling Method (Media)	Analyte(s)	Analytical Method
Main Line Cleaning and Sealing	8	Catch basins along 24-inch Pipe.	Grab sample from catch basin (water)	Alkalinity: Total HCO_3^-, CO_3^{-2}	USEPA 310.1-SM 2320
				Anions: Cl^-, SO_4^{-2}	USEPA 300.0
				Cations: Ca, K, Mg, Na	USEPA 6010B
				pH (acidity)	USEPA 305.1–SM 2310
				Salinity: Conductivity	USEPA 120.1
	7 plus 1 field duplicate	15-inch and 24-inch Pipes accessible from storm drains.	Grab of solid material accumul-ated on pipe wall (solids)	PCBs (Aroclor)	USEPA 8082
				TPH-D	NWTPH-Dx
				SVOCs	USEPA 8270D
				Metals: As, Cd, Cu, Pb, Ni, Zn	USEPA 6010B
Lateral Cleaning and Sealing	8 plus 1 field duplicate	2 samples each from 3 known laterals to 24-inch Pipe 1 sample from JF Outfall 9 1 sample from 6-inch lateral accessed at SDMH 36-83. Additional samples will be collected if additional laterals are identified.	Grab of solid material accu-mulated on pipe wall (solids)	PCBs (Aroclor)	USEPA 8082
				TPH-D	NWTPH-Dx
				SVOCs	USEPA 8270D
				Metals: As, Cd, Cu, Pb, Ni, Zn	USEPA 6010B

Task	Number of Samples[1]	Location	Sampling Method (Media)	Analyte(s)	Analytical Method
CMP Subsurface Soil Investigation	39 plus 3 field duplicates—one from each depth	3 samples from 13 borings along 3 northernmost transects parallel to CMP. Approximate sample depths: 3–5 feet bgs (above CMP), 10–12 feet bgs (below CMP), 2 feet below native contact.	Direct-push (soil)	PCBs (Aroclor)	USEPA 8082 (low level)
				TPH-D	NWTPH-Dx
				SVOCs	USEPA 8270D
				Metals: As, Cd, Cu, Pb, Ni, Zn	USEPA 6010B
	27 plus 3 field duplicates—one from each depth	3 samples from 9 borings along 3 southernmost transects parallel to CMP.	Direct-push (soil)	Archive for possible future analysis	Freeze to -18°C
CMP Groundwater Investigation	9 plus 1 field duplicate and 1 trip blank	1 sample from 3 easternmost borings along 3 northernmost transects parallel to CMP.	Direct-push (groundwater)	PCBs (Aroclor)	USEPA 8082 (low level)
				VOCs	USEPA 8260C
				Turbidity	Field meter

Note:
1 Estimates that may vary because of field conditions and observations.

Abbreviations:

As	
bgs	Below ground surface
Ca	Calcium
Cd	Cadmium
Cl^-	Chloride
CMP	Corrugated metal pipe
CO_3^{-2}	Carbonate
Cu	Copper
HCl	Hydrochloric acid
HCO_3^-	Bicarbonate
HNO3	Nitric acid
HDPE	High density polyethylene
JF	Jorgensen Forge
K	Potassium
Mg	Magnesium
Na	Sodium
NWTPH-Dx	Northwest TPH diesel range
Ni	Nickel
Pb	Lead
PCB	Polychlorinated biphenyl
SM	Standard Methods for examination of water and wastewater
SO_4^{-2}	Sulfate
SVOC	Semivolatile organic compound
TPH-D	Total petroleum hydrocarbons, diesel
USEPA	U. S. Environmental Protection Agency
VOA	Volatile Organic Analysis
VOC	Volatile organic compound
WMG	Wide-mouth glass jar
Zn	Zinc

Table B.2
Analytical Requirements, Methods, Preservation, Bottle Type, and Holding Times

Media	Analyses	Method	RL[1]	Bottle Type	Preservative	Holding Time
Surface Water	Alkalinity: Total HCO_3^-, CO_3^{-2}	USEPA 310.1-SM 2320	1.0 mg/L	500 mL HDPE (no headspace)	Cool to ≤ 6°C	14 days
	Anions: Cl^-, SO_4^{-2}	USEPA 300.0	0.10 mg/L	500 mL HDPE	Cool to ≤ 6°C	28 days
	Cations: Ca, K, Mg, Na	USEPA 6010B	Ca: 50 µg/L K, Na: 500 µg/L Mg: 50 µg/L	500 mL HDPE	HNO3 to pH<2, Cool to ≤ 6°C	6 months
	pH (acidity)	USEPA 305.1–SM 2310	0.01 units	500 mL HDPE	Cool to ≤ 6°C	14 days
	Salinity: Conductivity	USEPA 120.1	1.0 µS/cm	500 mL HDPE	Cool to ≤ 6°C	28 days
Pipe Solids and Subsurface Soil	PCBs (Aroclor)	USEPA 8082	33 µg/kg or 4 µg/kg (low level)	8 ounce WMG	Cool to ≤ 6°C	14 days (or freeze up to 1 year)
	TPH-D	NWTPH-Dx	5.0 mg/kg	8 ounce WMG	Cool to ≤ 6°C	14 days (or freeze up to 1 year)
	SVOCs	USEPA 8270D	67–670 µg/kg	8 ounce WMG	Cool to ≤ 6°C	14 days (or freeze up to 1 year)
	Metals: As, Cd, Cu, Pb, Ni, Zn	USEPA 6010B	As: 5.0 mg/kg Cd, Cu: 0.2 mg/kg Pb: 2.0 mg/kg Ni, Zn: 1.0 mg/kg	4 ounce WMG	Cool to ≤ 6°C	6 months (or freeze up to 1 year)

Media	Analyses	Method	RL[1]	Bottle Type	Preservative	Holding Time
Groundwater	PCBs (Aroclor)	USEPA 8082–low level	0.01 µg/L	Two 1L amber glass bottles (field-filtered)	Cool to ≤ 6˚C	7 days
	VOCs	USEPA 8260C	0.2–1.0 µg/L	Three 40-mL VOA vials (no headspace)	HCl to pH <2, cool to 6˚C	14 days

Note:

1 The Reporting Limit (RL) is defined as the lowest value at which qualitative detection of a given analyte is reported. The RL is based on the method detection limit, method efficiency, and analyte response.

Abbreviations:

As Arsenic
˚C Degree Celsius
Ca Calcium
Cd Cadmium
Cl^- Chloride
CO_3^{-2} Carbonate
Cu Copper
HCl Hydrochloric acid
HCO_3^- Bicarbonate
HNO3 Nitric acid
K Potassium
Mg Magnesium
Na Sodium
NWTPH-Dx Northwest TPH diesel range
Ni Nickel
Pb Lead
PCB Polychlorinated biphenyl
SM Standard Methods for examination of water and wastewater
SO_4^{-2} Sulfate
SVOC Semivolatile organic compound
TPH-D Total petroleum hydrocarbons, diesel
USEPA U. S. Environmental Protection Agency
VOA Volatile Organic Analysis
VOC Volatile organic compound
WMG Wide-mouth glass jar
Zn Zinc

Table B.3
Accuracy, Precision, and Completeness Goals

Matrix	Analyses	Method	RL[1]	Accuracy MS and LCS[2] (% Recovery)	Precision Duplicate or MS/MSD (Replicate RPD)	Completeness
Water	Alkalinity: Total HCO_3^-, CO_3^{-2}	USEPA 310.1-SM 2320	1.0 mg/L	75–125	20%	90%
Water	Anions: Cl^-, SO_4^{-2}	USEPA 300.0	0.10 mg/L	75–125	25%	90%
Water	Cations: Ca, K, Mg, Na	USEPA 6010B	Ca: 50 µg/L K, Na: 500 µg/L Mg: 50 µg/L	75–125	20%	90%
Water	pH (acidity)	USEPA 305.1–SM 2310	0.01 units	75–125	20%	90%
Water	Salinity: Conductivity	USEPA 120.1	1.0 µS/cm	75–125	20%	90%
Soil	PCBs (Aroclor)	USEPA 8082	33 µg/kg or 4 µg/kg (low level)	40–140	50%	90%
Soil	TPH-D	NWTPH-Dx	5.0 mg/kg	40–140	50%	90%
Soil	SVOCs	USEPA 8270D	67–670 µg/kg	10–160 [2]	50%	90%
Soil	Metals: As, Cd, Cu, Pb, Ni, Zn	USEPA 6010B	As: 5.0 Cd, Cu: 0.2 Pb: 2.0 Ni, Zn: 1.0 mg/kg	75–125	20%	90%
Water	PCBs (Aroclor)	USEPA 8082–low level	0.01 µg/L	46–131	20%	90%

Matrix	Analyses	Method	RL[1]	Accuracy MS and LCS[2] (% Recovery)	Precision Duplicate or MS/MSD (Replicate RPD)	Completeness
Water	VOCs	USEPA 8260C	0.2–1.0 µg/L	10–160[3]	20%	90%

Notes:

1 The Reporting Limit (RL) is defined as the lowest value at which qualitative detection of a given analyte is reported. The RL is based on the method detection limit, method efficiency, and analyte response.
2 Control limits are updated periodically. Contact the ARI Project Manager for current values.
3 Given range for all analytes. Default limits of 30–160 may apply for extractable samples based on preparation.

Abbreviations:

As Arsenic
Ca Calcium
Cd Cadmium
Cl- Chloride
CO_3^{-2} Carbonate
Cu Copper
HCl Hydrochloric acid
HCO_3^- Bicarbonate
HDPE High density polyethylene
HNO3 Nitric acid
K Potassium
LCS Laboratory Control Sample
Mg Magnesium
MS Matrix Spike
MSD Matrix Spike Duplicate
Na Sodium
NWTPH-Dx Northwest TPH, diesel range
Ni
Pb NickelLead
PCB Polychlorinated biphenyl
RPD Relative Percent Difference
SM Standard Methods for examination of water and wastewater
SO_4^{-2} Sulfate
SVOC Semivolatile organic compound
USEPA U. S. Environmental Protection Agency
VOA Volatile Organic Analysis
VOC Volatile organic compound
WMG Wide-mouth glass jar
Zn Zinc

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15-inch and 24-inch Pipes Cleanout Work Plan

Appendix B
Sampling and Analysis Plan/ Quality Assurance Project Plan

Figures

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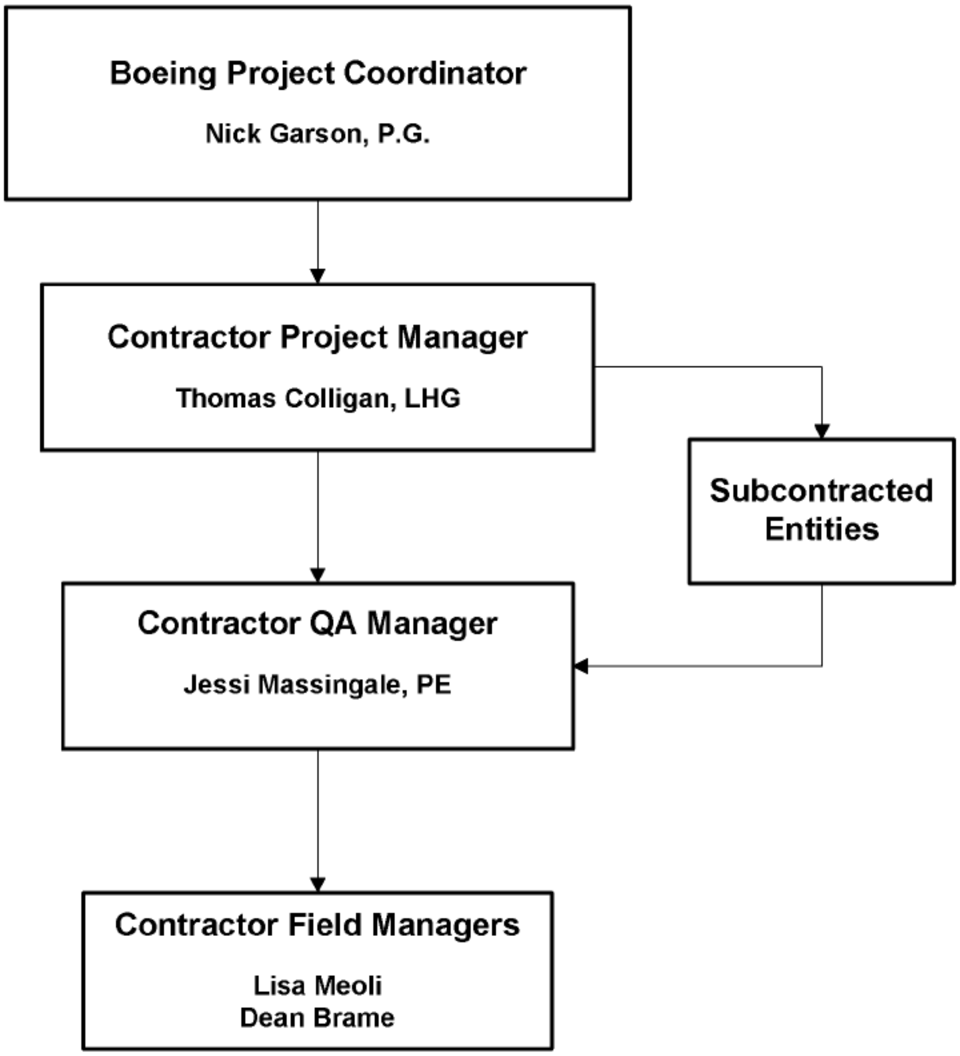

Organization	Name	Project Title	Address	Phone Office/ Cell
The Boeing Company, EHS Remediation Group	Nick Garson, P.G.	Project Coordinator	P.O. Box 3707 Mail Code 9U4-26 Seattle, WA 98124-2207	425-237-1974/ (b) (6)
Floyd|Snider	Thomas Colligan, LHG	Project Manager	601 Union Street Suite 600 Seattle, WA 98101	206-292-2078/ (b) (6)
	Jessi Massingale, PE	QA Manager	Correspondence through PM	206-292-2078/ (b) (6)
	Lisa Meoli	Field Manager	Correspondence through PM	206-292-2078/ (b) (6)
	Dean Brame	Field Manager	Correspondence through PM	206-292-2078/ (b) (6)
ClearCreek Contractors	Mark McCullough	Subcontractor	3203 15th Street Everett, WA 98021	425-252-5800
Bravo Environmental	Al Schumacher	Subcontractor	6705 NE 175th Street Kenmore, WA 98028	425-424-9000/ (b) (6)
Sayler Data Solutions	Cari Sayler	Subcontractor	14257 93rd Court NE Bothell, WA 98011	425-820-7504

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15-inch and 24-inch Pipes Cleanout Work Plan
Jorgensen Forge Outfall Site Source Control Action
Seattle, Washington

Figure B.1
Project Organization and Contact Information

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December 17, 2010

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Sampling and Analysis Plan/ Quality Assurance Project Plan

Attachment B.1

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Jorgensen Forge Outfall Site
Seattle, Washington

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15-inch and 24-inch Pipes Cleanout Work Plan

Quality Management Plan

Prepared for

The Boeing Company
P.O. Box 3707
Seattle, Washington 98124-2207

Prepared by

FLOYD | SNIDER
601 Union Street
Suite 600
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December 17, 2010

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1.0 Introduction

The following Quality Management Plan will be implemented by Floyd|Snider, the contractor selected by The Boeing Company (Boeing) to implement the work described in the Administrative Order on Consent for Removal Action (Order), CERCLA Docket No. 10-2011-0017. One requirement of the Order is to provide the U. S. Environmental Protection Agency (USEPA) a Quality Management Plan (QMP) for the project contractor. This QMP was developed in general accordance with "EPA Requirements for Quality Management Plans (QA/R-2) and ANSI/ASQC E-4-1994, Specifications and Guidelines for Quality Systems for Environmental Data Collection and -Environmental Technology Programs" (American National Standard 1995).

The purpose of this QMP is to describe the firm-wide quality system elements necessary to meet the Quality Control (QC) and Quality Assurance (QA) requirements for the project objectives detailed in the 15-inch and 24-inch Property Line Storm Pipes Cleanup Work Plan (Work Plan). These firm-wide elements provide the foundation on which the Quality Assurance Project Plan (QAPP) for the project may be successfully implemented. The quality system elements specific to this project are:

- quality assurance personnel roles and responsibilities,
- data quality management procedures and policies, and
- training requirements.

2.0 Project Organization

1.1 PROJECT QUALITY ORGANIZATION—ROLES AND RESPONSIBILITIES

The entire Floyd|Snider team has the responsibility and authority to ensure achievement of the quality objectives as identified in the project-specific QAPP. The primary roles and responsibilities of the individuals that comprise the Project Quality Organization are summarized below.

1.1.1 Project Manager—Thomas Colligan

Thomas Colligan is the Project Manager for Floyd|Snider and is the overall project Environmental Task Manager providing project implementation and technical oversight on behalf of Boeing. Mr. Colligan will have overall responsibility for project implementation (via selected subcontractors) and project data quality assurance procedures to ensure that technical and contractual requirements are met. The roles of the Project Manager include the following:

- Review and approve the Floyd|Snider QAPP for the project.
- Periodically review Floyd|Snider's project quality performance.
- Designate appropriate trained personnel within the Floyd|Snider team to perform periodic inspections.
- Review periodic review of the Project-specific QMP and project QAPP to ensure that the plan's ongoing suitability and effectiveness are satisfying the requirements of the QAPP.
- Certify that all Floyd|Snider documents submitted under the contract have been subjected to all required firm-wide QA/QC procedures.

1.1.2 Environmental Data QA Manager—Jessi Massingale

Jessi Massingale is the Floyd|Snider QA Manager and will report to the Project Manager. The QA Manager is responsible for ensuring that all environmental data QA/QC procedures are adequately rigorous to meet project objectives. Additional responsibilities include the following:

- Oversee project QAPP design.
- Review and approve the QA/QC policy of each project laboratory
- Approve field QA/QC design and advise technical staff on procedures.
- Supervise data validation performed by Floyd|Snider technical staff.
- Review data validation reports performed by a Floyd|Snider subcontractor.
- Advise the Project Manager on data corrective action procedures.
- Perform review and implement changes to the firm-wide QA/QC procedures.

1.1.3 Technical Staff

The Floyd|Snider technical project staff report directly to the Floyd|Snider Project Manager and will be responsible for ensuring that all QA/QC procedures specified in the project-specific QMP and project QAPP are being followed. The Floyd|Snider technical staff responsibilities include the following:

- Execute work activities according to work plans and procedures to meet all QC requirements and in accordance with the QAPP
- Fill out the chain-of-custody and ensure that the samples are cooled to the appropriate temperature.
- Interact with the laboratory if any sample bottle problems are noted upon receipt at the laboratory.
- Validate the analytical data accordance to established EPA protocols for data validation.
- Load electronic laboratory data into the Floyd|Snider database in accordance with the Floyd|Snider database procedures
- Follow Floyd|Snider document review procedures to meet document quality control requirements.
- Review documents for consistency with Floyd|Snider style manual and document management system.
- Report any non-compliance with QMP or QAPP to the Project Manager.
- Provide assistance during review of the quality system.

3.0 Communications

Floyd|Snider will work to ensure project communication follows the necessary chain of command as required by the contract. Floyd|Snider will channel all communication to USEPA from the Floyd|Snider Team through the Boeing Project Coordinator, Mr. Nick Garson.

Upon completion of the Floyd|Snider document control procedure, project documents will be sent to the Boeing Project Coordinator for review and subsequent dissemination. Upon approval by Boeing, Floyd|Snider may send project documents directly to the USEPA Project Coordinator by email, parcel post, express package service, courier, or similar methods that provide confirmation of USEPA receipt.

4.0 Document Protocols

2.1 DOCUMENT CONTROL

All electronic information required by the contract that is necessary to document project performance and task completion will be maintained in an organized manner on an internal Floyd|Snider server and provided to the Boeing Project Coordinator. The Project Coordinator will have the ability to access all of the pertinent documents needed to monitor Floyd|Snider's performance in administering the project work plan and associated QAPP. Hard copy project documents will be filed in a specific file area and retained by Floyd|Snider for a period of 10 years.

2.3 REVISIONS TO FLOYD|SNIDER PREPARED DOCUMENTS

Electronic documents that will evolve over the course of the project, prior to final agency submittal, will be backed up on the internal Floyd|Snider server. Old document editions will be stored in a superseded folder and tracking control will be implemented by assigning a date to the file name. This allows Floyd|Snider to maintain all document editions available for viewing while prominently displaying the most current version for project personnel to open and review. Following project completion, all internal draft electronic documents will be permanently deleted from the server.

Hard copies of any controlled documents are to be considered reference only. The only controlled version considered being correct and to date will be the most current posted to the Floyd|Snider server. All project personnel are required to reference the controlled documents to ensure they are referring to the most current information and requirements.

2.4 TECHNICAL EDITING DOCUMENT CONTROL

2.4.1 Purpose and Responsibilities

Floyd|Snider will maintain a high level of technical editing on all documents produced and reviewed. All documents, including internal memorandums, will be reviewed by the Project Manager. For major deliverables, such as work plans and investigation reports, internal reviews by the technical staff will be followed by document control edits and review by the Project Manager prior to submittal to the Boeing Project Coordinator. All email messages written to document a completed deliverable review will be archived to ensure QA/QC compliance.

2.4.3 Document Editing Procedures

2.4.3.1 Requirements

Each major deliverable must meet the following requirements:

1. Assumptions are verified.
2. Conclusions and recommendations can be justified.

3. Grammar, workmanship of drawings, printing, and document binding is commensurate with accepted practices.
4. Review of technical components has been conducted by qualified personnel.

2.4.3.2 Electronic Check Process

The technical content of the document will be reviewed by the Project Manager. Spelling, grammar, style, and formatting will be reviewed by the Technical Editor. Reviewers will provide comments and edits electronically using the track changes mode. Each time a document is reviewed, a new file will be saved with a new file name containing the date and reviewer's initials. The original document will be archived. After review, the originator will review the reviewer comments and either (a) accept the changes, or (b) consult with the reviewer to have comment resolution. Following a document review by the originator, the file will be saved with a new file name containing the date and the originator's initials. Email documenting the review process will be archived.

Once the Floyd|Snider review and comment resolution process has been completed, the document will be sent to the Boeing Project Coordinator for review. The Project Coordinator will use the track changes mode and will save the file with a new file name. The Floyd|Snider Project Manager will either accept the changes or work with the Boeing Project Coordinator to resolve comments. Once a document is submitted to USEPA and approved, all prior draft electronic documents will be deleted. A copy of the final electronic document submitted to USEPA will be retained permanently on the Floyd|Snider server.

5.0 Data Management

5.1 DATA REVIEW AND VALIDATION

Floyd|Snider will review the laboratory reports for internal consistency, transmittal errors, laboratory protocols, and for adherence to the data quality objectives as specified in the project Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP). Data validation of all analytical data will be performed by Floyd|Snider or qualified subcontractor as described in the project SAP/QAPP.

Data Quality Review (Summary Validation) includes the following:

- Evaluation of package completeness.
- Verification that sample numbers and analyses match those requested on the Chain-of-Custody Form.
- Review of method-specified preservation and sample holding times.
- Verification that the required detection limits and reporting limits have been achieved.
- Verification that the field duplicates, MS/MSDs, and laboratory control samples were analyzed at the proper frequency.
- Verification of analytical precision and accuracy via replicate analysis and analyte recoveries.
- Verification that the surrogate compound analyses have been performed and meet QC criteria.
- Verification that the laboratory method blanks were free of contaminants.
- For Level III Data Review, instrument performance—initial calibration, continuing calibration, tuning, sensitivity, and degradation are reviewed.

Data validation will be based on the QC criteria as recommended in the methods identified in the project SAP/QAPP and in the National Functional Guidelines for Organic and Inorganic Data Review (USEPA 2008 and 2004).

Data usability, conformance with the DQOs, and any deviations that may have affected the quality of the data, as well as the basis of application of qualifiers, will be included in the final reporting of the data. Any required corrective actions based on the evaluation of the analytical data will be determined by the Laboratory Project Manager and Data Validator in consultation with the Floyd|Snider QA Manager and may include qualification or rejection of the data.

5.2 DATA MANAGEMENT

Floyd|Snider owns and maintains a custom database to store and query environmental chemistry results. This database will be used during the Work Plan activities and data can be queried as needed. All collected field data will be entered into the database. Analytical laboratory data will be received in an electronic data deliverable format suitable for import into the database. Both laboratory data qualifiers and external data validation qualifiers will be stored in the database. The database is managed and stored in a Structured Query Language (SQL) Server and subject to electronic backup every 2 hours.

Data will be mapped in ArcGIS v9.3 as needed. Furthermore, specialized queries may be written to aid in data analyses. Queried data will be tabulated in Excel spreadsheet format. Excel spreadsheets will be formatted to be compatible with export of data to comma separated values format. All numerical data such as coordinates, concentration values, distances, depths will be entered into the Excel spreadsheet as numbers.

6.0 Personnel Training

All personnel on the project will be made aware of the quality requirements of their position. Personnel will be trained in their job duties and the skills necessary to complete their work. Logs documenting training are completed by following specific personal training sessions.

Floyd|Snider staff, depending upon their position and prior experience, are trained on appropriate sampling techniques, data validation, database entry, document control, and communication procedures. Much of this training occurs internally by more senior staff training more junior staff in the field or office.

7.0 References

American National Standard. 1995. *Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs*. 5 January.

U. S. Environmental Protection Agency (USEPA). 2004. *USEPA National Contract Laboratory Program National Functional Guidelines for Inorganic Data Review.* OSWER 9240.1-45, EPA 540-R-04-004. Office of Superfund Remediation and Technology Innovation (OSRTI), Washington, D.C. October.

U. S. Environmental Protection Agency (USEPA). 2008. USEPA Contract Laboratory Program, National Functional Guidelines for Organic Data Review. EPA-540/R-99/008. October.

Jorgensen Forge Outfall Site
Seattle, Washington

Source Control Action

15-inch and 24-inch Pipes Cleanout Work Plan

Appendix B
Sampling and Analysis Plan/ Quality Assurance Project Plan

Attachment B.2

FINAL

GROUNDWATER SAMPLE COLLECTION FORM

Project Name:______________________ Date of Collection: ______________________

Project Number:______________________ Field Personnel: ______________________

Purge Data

Well ID: ______________ Secure: ☐ Yes ☐ No Well Condition/Damage Description: ______________

____

Depth Sounder decontaminated Prior to Placement in Well: ☐ Yes ☐ No One Casing Volume (gal): ______________

Depth of water (from top of well casing): ______________ Well Casing Type/Diameter/Screened Interval: ______________

After 5 minutes of purging (from top of casing): ______________

Begin purge (time):______________

End purge (time): ______________

Gallons purged: ______________

Purge water disposal method: ______________

Volume of Schedule 40 PVC Pipe				
Diameter	O.D.	I.D.	Volume (Gal/Linear Ft.)	Weight of Water (Lbs/Lineal Ft.)
1 ¼”	1.660”	1.380”	0.08	0.64
2”	2.375”	2.067”	0.17	1.45
3”	3.500”	3.068”	0.38	3.2
4”	4.500”	4.026”	0.66	5.51
6”	6.625”	6.065”	1.5	12.5

Time	Depth to Water	Vol. Purged	pH	DO	Conductivity	Turbidity	Temp	Comments

Sampling Data

Sample No:______________ Location and Depth: ______________

Date Collected (mo/dy/yr): ______________ Time Collected: ______________ ☐ AM ☐ PM Weather: ______________

Type: ☐ Ground Water ☐ Surface Water Other: ______________ Sample: ☐ Filtered ☐ Unfiltered Other: ______________

Sample Collected with: ☐ Bailer ☐ Pump Other: ______________ Type: (circle one) Peristaltic pump, disposable silicon and poly tubing

Sample Decon Procedure: Sample collected with disposable tubing

Sample Description (Color, Turbidity, Odor, Other): ______________

Sample Analyses

TPH-D	(HCl) ☐	Chlor / Fluor	(unpres) ☐	COD / TOC	(H2SO4) ☐	Orthophos	(FILTER)☐	Diss. Metals	(HNO3) ☐
TPH-G	(HCl) ☐	BTEX	(HCl) ☐	Total Metals	(HNO3) ☐	TKN/Phos	(N2SO4) ☐	VOCs	(HCl) ☐

Additional Information

Types of Sample Containers:	Quantity:	Duplicate Sample Numbers:	Comments:

Signature: ______________________ **Date:** ______________

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	Drill Date:	**Boring ID:**
	Logged By:	
	Drilled By:	
Coordinate System:	Drill Type:	Client:
Ground Surface Elevation:	Sample Method:	Project:
Latitude/Northing:	Boring Diameter:	Task:
Longitude/Easting:	Boring Depth (ft bgs):	Address:
Boring Location:	Groundwater ATD (ft bgs):	

Remarks:

PID (ppm)	SAMPLE INTERVAL	SAMPLE ID	DRIVEN / RECOVERED	DEPTH FT BGS	USCS SYMBOL	SOIL DESCRIPTION AND OBSERVATIONS (color, texture, moisture, MAJOR CONSITIUENT, odor, staining, sheen, debris, etc.)
				0		
				1		
				2		
				3		
				4		
				5		
				6		
				7		
				8		
				9		
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

Notes:
FT BGS = feet below ground surface
ppm = parts per million
--- Dashed contact line in soil description indicates a gradational contact
USCS = Unified Soil Classification System
▼ = denotes groundwater table

Jorgensen Forge Outfall Site
Seattle, Washington

Source Control Action

15-inch and 24-inch Pipes Cleanout Work Plan

Appendix C
Health and Safety Plan

FINAL

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List of Abbreviations and Acronyms

Acronym/Abbreviation	Definition
CRZ	Contamination reduction zone
DOT	Department of Transportation
EZ	Exclusion zone
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations Training
HSO	Health and Safety Officer
L&I	Washington State Department of Labor and Industries
OSHA	Occupational Safety and Health Act
PEL	Permissible Exposure Limit
PID	Photoionization detector
PPE	Personal protective equipment

Acronym/Abbreviation	Definition
PCB	Polychlorinated biphenyl
PM	Project Manager
Site	Jorgensen Forge Corporation Property at 8531 East Marginal Way South in Seattle, Washington
SS	Site Supervisor
SSO	Site Safety Officer
SZ	Support zone
VOC	Volatile organic compound
WAC	Washington Administrative Code
WISHA	Washington Industrial Safety and Health Act

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1.0 Plan Objectives and Applicability

This Health and Safety Plan (HASP) has been written to comply with the standards prescribed by the Occupational Safety and Health Act (OSHA) and the Washington Industrial Safety and Health Act (WISHA).

The purpose of this HASP is to establish protection standards and mandatory safe practices and procedures for all personnel involved with on-site work activities associated with the 15-inch and 24-inch Property Line Storm Pipes Cleanup Work Plan (Work Plan) to be conducted on the Jorgensen Forge Corporation Property at 8531 East Marginal Way South in Seattle, Washington (Site; Figure C.1). The work will include inspecting Property Line Storm Pipes (collectively, Pipes), collecting samples of material within the Pipes, sampling of subsurface soil and groundwater, and conducting a tidal survey. This HASP assigns responsibilities, establishes standard operating procedures, and provides for contingencies that may occur during field work activities. The plan consists of site descriptions, a summary of work activities, an identification and evaluation of chemical and physical hazards, monitoring procedures, personnel responsibilities, a description of site zones, decontamination and disposal practices, emergency procedures, and administrative requirements.

The provisions and procedures outlined by this HASP apply to all Floyd|Snider personnel on-site. Contractors, subcontractors, other oversight personnel, and all other persons involved with the field work activities described herein are required to develop and comply with their own HASP. All Floyd|Snider staff conducting field activities are required to read this HASP and indicate that they understand its contents by signing the Health and Safety Officer/Site Supervisor's (HSO/SS) copy of this plan.

It should be noted that this HASP is based on information that was available as of the date indicated on the title page. It is possible that additional hazards that are not specifically addressed by this HASP may exist at the work site, or may be created as a result of on-site activities. It is the firm belief of Floyd|Snider that active participation in health and safety procedures and acute awareness of on-site conditions by all workers is crucial to the health and safety of everyone involved. Should project personnel identify a site condition that is not addressed by this HASP or have any questions or concerns about site conditions, they should immediately notify the HSO/SS and an addendum will be provided to this HASP.

The HSO/SS has field responsibility for ensuring that the provisions outlined herein adequately protect worker health and safety and that the procedures outlined by this HASP are properly implemented. In this capacity, the HSO/SS will conduct regular site inspections to ensure that this HASP remains current with potentially changing site conditions. The HSO/SS has the authority to make health and safety decisions that may not be specifically outlined in this HASP should site conditions warrant such actions. In the event that the HSO/SS leaves the Site while work is in progress, an alternate Site Safety Officer (SSO) will be designated. Personnel responsibilities are further described in Section 4.0.

This HASP has been reviewed by the Project Manager (PM) and the HSO/SS prior to commencement of work activities. All Floyd|Snider personnel shall review the plan and be familiar with on-site health and safety procedures. A copy of the HASP will be on-site at all times.

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2.0 Emergency Contacts and Information

2.1 DIAL 911

In the event of any emergency, DIAL 911 to reach fire, police, and first aid.

2.2 HOSPITAL AND POISON CONTROL

Nearest Hospital Location and Telephone: **(Refer to Figure C.1 for map and directions to the hospital.)**	Harborview Medical Center 325 9th Avenue Seattle, WA 98104 (206) 731-3000
Washington Poison Control Center:	(800) 222-1222

2.3 PROVIDE INFORMATION TO EMERGENCY PERSONNEL

All Floyd|Snider project personnel should be prepared to give the following information:

Information to give to Emergency Personnel	
Site Location: **(Refer to Figure C.2 for directions and map to the Site.)**	Jorgensen Forge Corporation 8531 East Marginal Way South Seattle, WA 98108
Number that you are calling from:	Look on the phone you are calling from.
Describe accident and/or incident and numbers of personnel needing assistance.	Type of Accident Type(s) of Injuries

2.4 FLOYD|SNIDER AND BOEING COMPANY EMERGENCY CONTACTS

After contacting emergency response crews as necessary, contact the Floyd|Snider PM or a Principal to report the emergency. The Principal may then contact The Boeing Company or direct the field staff to do so.

Emergency Contacts

Floyd|Snider
Tom Colligan (PM) Office: (206) 292-2708 Cell: (b) (6)
Teri Floyd (Principal) Office: (206) 292-2708 Cell:

The Boeing Company
Boeing Emergency Number (206) 655-2222
Nick Garson (Project Coordinator) Cell: (b) (6)

Jorgensen Forge Corporation
Wayne Desberg 206) 300-7235

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3.0 Background Information

3.1 SITE BACKGROUND

Floyd|Snider will conduct field investigation and data collection activities described in the Work Plan on behalf of The Boeing Company on the Jorgensen Forge Corporation Property at 8531 East Marginal Way South in Seattle, Washington (Figure C.1). The work will include inspecting Property Line Storm Pipes (collectively, Pipes); collecting samples of material within the Pipes, surface soil, subsurface soil, and groundwater; and conducting a tidal survey.

Previous investigations, detailed in the Work Plan, have documented the presence of elevated concentrations of polychlorinated biphenyls (PCBs) in solids within the Pipes. The U.S. Environmental Protection Agency (USEPA) Office of Emergency Response has been designated as the lead agency for ensuring that the PCBs within these Pipes are not a source of contamination to the adjacent Lower Duwamish Waterway (LDW). The objective of the Work Plan is to:

- investigate the nature and extent of contamination related to the Pipes, and
- clean and seal the Pipes to eliminate the potential for discharges from these Pipes to the LDW.

3.2 SCOPE OF WORK

Supporting information and rationale for the project activities is presented in the Work Plan. The project activities focus on the cleanout and sealing of the Pipes and investigating an area of the bank traversed by the Pipes. The proposed activities include the following:

- Conducting a tidal elevation survey of the 24-inch Pipe and associated laterals prior to cleanout and closure.
- Sampling and chemical analysis of solids for source tracing.
- Cleaning and permanently sealing the Pipes and associated laterals to eliminate discharge to the LDW.
- Waste characterization of water and solids generated from the cleaning process.
- Investigating the nature and extent of contamination in the area of the bank traversed by the Corrugated Metal Pipe (CMP) segments of the Pipes.

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4.0 Primary Responsibilities and Requirements

4.1 PROJECT MANAGER

The PM will have overall responsibility for the completion of the project, including the implementation and review of this HASP. The PM will review health and safety issues as needed and as consulted, and will have the authority to allocate resources and personnel to safely accomplish the field work.

The PM will direct all Floyd|Snider personnel involved in field work at the Site. If the project scope changes, the PM will notify the HSO/SS so that the appropriate addendum can be included in the HASP. The PM will ensure that all Floyd|Snider personnel on-site have received the required training, are familiar with the HASP, and understand the procedures to follow should an accident and/or incident occur on-site.

4.2 HEALTH AND SAFETY OFFICER AND SITE SUPERVISOR

The HSO/SS will approve this HASP and any amendments thereof, and will ultimately be responsible for full implementation of all elements of the HASP.

The HSO/SS will advise the PM and project personnel on all potential health and safety issues of the field investigation activities to be conducted at the Site. The HSO/SS will specify required exposure monitoring to assess site health and safety conditions, modify the site HASP based on field assessment of health and safety accidents and/or incidents, and recommend corrective action if needed. The HSO/SS will report all accidents and/or incidents to the PM. If the HSO/SS observes unsafe working conditions by Floyd|Snider personnel or any contractor personnel, the HSO/SS will suspend all work until the hazard has been addressed.

4.3 SITE SAFETY OFFICER

The SSO may be a person dedicated to this task, to assist the HSO/SS during field work activities. The SSO will ensure that all personnel have appropriate personal protective equipment (PPE) on-site and that the PPE is properly used. The SSO will assist the HSO/SS in field observation of Floyd|Snider personnel safety. If a health or safety hazard is observed, the SSO shall suspend all work activity. The SSO will conduct on-site safety meetings daily before work commences. All health and safety equipment will be calibrated daily and records kept in the daily field logbook. The SSO may perform exposure monitoring if needed and will ensure that equipment is properly maintained.

4.4 FLOYD|SNIDER PROJECT PERSONNEL

All Floyd|Snider project personnel involved in field work activities will take precautions to prevent accidents and/or incidents from occurring to themselves and others in the work areas. Employees will report all accidents, incidents, and/or other unsafe working conditions to the HSO/SS or SSO immediately. Employees will inform the HSO/SS or SSO of any physical conditions that could impact their ability to perform field work.

4.5 TRAINING REQUIREMENTS

All Floyd|Snider project personnel must comply with applicable regulations specified in the Washington Administrative Code (WAC) Chapter 296-843, Hazardous Waste Operations Training (HAZWOPER), administered by the Washington State Department of Labor and Industries (L&I). Project personnel will be 40-hour HAZWOPER trained and maintain their training with an annual 8-hour refresher. Personnel with limited tasks and minimal exposure potential will be required to have 24-hour training and a site hazard briefing, and be escorted by a trained employee. Personnel with defined tasks that do not include potential contact with disturbed site soils or waste, groundwater, or exposures to visible dust (e.g., surveying) are not required to have any level of hazardous waste training beyond a site emergency briefing and hazard orientation by the HSO/SS. Floyd|Snider project personnel will fulfill the medical surveillance program requirements.

In addition to the 40-hour course and 8-hour refreshers, the HSO/SS will have completed an 8-hour HAZWOPER Supervisor training as required by WAC 296-843-20015. At least one person on-site during field work will have current CPR/First Aid certification. All field personnel must have a minimum of 3 days of hazardous materials field experience under the direction of a skilled supervisor. Documentation of all required training will be maintained on-site in a 3-ring binder or similar device and kept either in the HSO/SS vehicle or equipment storage bin.

Additional site-specific training that covers on-site hazards, PPE requirements, use and limitations, decontamination procedures, and emergency response information as outlined in this HASP will be given by the HSO/SS before on-site work activities begin. Daily health and safety meetings will be documented on the Daily Tailgate Safety Meeting form included in this HASP.

4.6 MEDICAL SURVEILLANCE

All Floyd|Snider field personnel are required to participate in Floyd|Snider's medical surveillance program, which includes biennial audiometric and physical examinations for employees involved in HAZWOPER projects. The program requires medical clearance before respirator use or participating in HAZWOPER activities. Medical examinations must be completed before conducting field work activities and on a biennial basis.

5.0 Hazard Evaluation and Risk Analysis

In general, there are three broad hazard categories that may be encountered during site work: chemical exposure hazards, fire/explosion hazards, and physical hazards. Sections 5.1 through 5.3 discuss the specific hazards that fall within each of these broad categories.

5.1 CHEMICAL EXPOSURE HAZARDS

This section describes potential chemical hazards associated with: inspection of the Pipes; collecting samples of material within the Pipes, surface soil, subsurface soil, and groundwater; and conducting a tidal survey. Based on previous site investigation information, the following chemicals are present at this Site and have been retained as site constituents of concern (COCs):

- Metals in sediment, soil and groundwater.
- Polycyclic aromatic hydrocarbons (PAHs) in soil and groundwater.
- Diesel range and heavy oil range hydrocarbons in soil and groundwater.
- PCBs in soil and groundwater.
- Volatile organic compounds (VOCs) in soil and groundwater.
- Semivolatile organic compounds (SVOCs) in soil.

Human health hazards of these chemicals are discussed in the table below. This information covers potential toxic effects that might occur if relatively significant acute and/or chronic exposure were to happen. This information does not mean that such effects will occur from planned site activities. Potential routes of exposure include inhalation, dermal contact, ingestion, and eye contact. The primary exposure route of concern during site work is ingestion of contaminated water or soil, though such exposure is considered unlikely and highly preventable. In general, the chemicals that may be encountered at this Site are not expected to be present at concentrations that could produce significant exposures. The types of planned work activities and use of monitoring procedures and protective measures will limit potential exposures at this Site. The use of appropriate PPE and decontamination practices will assist in controlling exposure through all pathways to the key contaminants of concern listed in the table below.

Chemical Hazard	PEL	Routes of Exposure	Target Organs	Potential Toxic Effects
Arsenic (elemental)	0.01 mg/m^3 in air	Inhalation, ingestion, skin/eye contact	Respiratory system, GI system, liver, central nervous system, blood	Irritation of skin; dermatitis, respiratory distress, diarrhea, kidney damage, muscle tremor, convulsions

Chemical Hazard	PEL	Routes of Exposure	Target Organs	Potential Toxic Effects
Cadmium (dust)	0.005 mg/m^3 in air	Inhalation, ingestion, skin/eye contact	Respiratory system, kidneys, prostate, blood	Pulmonary edema, dyspnea, cough, chest tightness, substernal pain, headache, chills, muscular aches, nausea, vomiting, diarrhea, anosmia, emphysema, proteinuria, mild anemia
Copper (dust)	1 mg/m^3 in air	Inhalation, ingestion, skin/eye contact	Eyes, skin, respiratory system, liver, kidneys	Eye irritation, respiratory system irritation, nasal septum perforation, metallic taste, dermatitis
Diesel- range Hydrocarbons	None	Inhalation, skin/eye contact	Eyes, skin, respiratory system, GI system, liver, kidneys, central nervous system	Irritation to eyes, pulmonary function
Lead	0.1 mg/m^3 in air	Inhalation, ingestion, skin/eye contact	Central nervous system, kidneys, blood, reproductive organs	Weakness, insomnia, facial pallor, weight loss, constipation, abdominal pain, anemia, tremors, eye irritation, hypotension
Nickel	1.0 mg/m^3 in air	Inhalation, ingestion, skin/eye contact	Skin, cardiovascular system, kidneys, central nervous system	Itching and skin eruptions of the hands and arms (most frequently when the skin is moist), asthma, nausea, vomiting, diarrhea
Polychlorinated Biphenyl (Aroclor)	0.5 mg/m^3 in air	Inhalation, skin absorption, ingestion, skin and/or eye contact	Skin, liver, reproductive organs	Eye irritation, chloracne, liver damage, reproductive effects; potential occupational carcinogen
Trichloroethene	100 ppm	Inhalation, ingestion, absorption, skin/eye contact	Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system	Skin/eye irritation, headache, visual disturbance, dizziness, tremor, drowsiness, nausea, vomiting, dermatitis, cardiac arrhythmias

Chemical Hazard	PEL	Routes of Exposure	Target Organs	Potential Toxic Effects
Vinyl Chloride	0.5 ppm	Inhalation, skin/eye contact	Liver, central nervous system, blood, respiratory system, lymphatic system	Abdominal pain, GI bleeding, pallor or cyanosis of extremities
Zinc (dust)	15 mg/m^3 in air	Inhalation	Respiratory system	Metal fume fever: chills, muscle ache, nausea, fever, dry throat and cough; metallic taste; headache; blurred vision; vomiting; decreased pulmonary function

Abbreviation:
PEL Permissible Exposure Limit (OSHA) Table Z-1 in 29 CFR 1910.1000. Given as an 8-hour time-weighted average (TWA) concentration.

5.2 FIRE AND EXPLOSION HAZARDS

Flammable and combustible liquid hazards may occur from fuels and lubricants brought to the property to support heavy equipment. When on-site storage is necessary, such material will be stored in containers approved by the Department of Transportation (DOT) in a location not exposed to strike hazards and provided with secondary containment. A minimum 2-A:20-B fire extinguisher will be located within 25 feet of the storage location and where refueling occurs. Any subcontractors bringing flammable and combustible liquid hazards to the Site are responsible for providing appropriate material for containment and spill response, and such hazards should be addressed in their respective HASP. Transferring of flammable liquids (e.g., gasoline) will occur only after making positive metal to metal connection between the containers. A bonding strap may be necessary to achieve this. Storage of ignition and combustible materials will be kept away from storage and fueling operations.

5.3 PHYSICAL HAZARDS

When working in or around any hazardous or potentially hazardous substances or situations, all site personnel should plan all activities before starting any task. Site personnel shall identify health and safety hazards involved with the work planned and consult with the HSO/SS as to how the task can be performed in the safest manner. Personnel will also consult the HSO/SS if they have any concerns or uncertainties.

All field personnel will adhere to general safety rules including wearing appropriate PPE, hard hats, steel-toed boots, safety vests, and safety glasses. Eating, drinking, and/or use of tobacco or cosmetics will be restricted in all work areas. Personnel will prevent splashing of liquids containing chemicals and minimize dust emissions.

The following table summarizes a variety of physical hazards that may be encountered on the Site during work activities. For convenience, these hazards have been categorized into several general groupings with recommended preventative measures.

Hazard	Cause	Prevention
Head Strike	Falling and/or sharp objects, bumping hazards.	Hard hats will be worn by all personnel at all times when overhead hazards exist, such as during drilling activities and around large, heavy equipment.
Foot/ankle twist, Crush, Slip/trip/fall	Sharp objects, dropped objects, uneven and/or slippery surfaces.	Steel-toed boots must be worn at all times on-site while heavy equipment is present. Pay attention to footing on uneven or wet terrain and do not run. Keep work areas organized and free from unmarked trip hazards.
Hand Cuts, Splinters, and Chemical Contact	Hands or fingers pinched or crushed, chemical hazards including dermal exposure to nitric acid or sulfuric acid preservative. Cut or splinters from handling sharp/rough objects and tools.	***Nitrile*** safety gloves will be worn to protect the hands from dust and chemicals. Leather or cotton outer gloves will be used when handling sharp-edged rough materials or equipment. (Refer to the preventive measures for Mechanical Hazards below.)
Eye Damage from Flying Materials, or Splash Hazards	Sharp objects, poor lighting, exposure due to flying debris or splashes.	Safety glasses will be worn at all times on-site. If a pressure washer is used to decontaminate heavy equipment, a face shield will be worn over safety glasses or goggles. Care will be taken during decontamination procedures and groundwater sampling to avoid splashing or dropping equipment into decontamination water. Face shields may be worn over safety glasses if splashing is occurring during sampling, decontamination, or well slug testing.
Electrical Hazards	Underground utilities, overhead utilities, electrical cord hazards.	Utility locator service will be used prior to any investigation to locate all underground utilities. Visual inspection of work areas will be conducted prior to starting work. Whenever possible, avoid working under overhead high voltage lines. Make sure that no damage to extension cords occurs. If an extension cord is used, make sure it is the proper size for the load that is being served and rated SJOW or STOW (an "-A" extension is acceptable for either) and inspected prior to use for defects. The plug connection on each end should be of good integrity. Insulation must be intact and extend to the plugs at either end of the cord. All portable power tools will be inspected for defects before use and must either be a double-insulated design or grounded with a ground-fault circuit interrupter (GFCI).

Hazard	Cause	Prevention
Mechanical Hazards	Heavy equipment such as drill rigs, service trucks, mowing equipment, saws, drills, etc. Conducting work in road right of ways (on the road shoulder).	Ensure the use of competent operators, backup alarms, regular maintenance, daily mechanical checks, and proper guards. Subcontractors will supply their own HASP. All project personnel will make eye contact with operator and obtain a clear OK before approaching or working within swing radius of heavy equipment, staying clear of swing radius. Obey on-site speed limits.
Traffic Hazards	Vehicle traffic and hazards when working near public right-of-ways and in/around Shipyard operations.	When working around active Site operations, orange cones and/or flagging will be placed around the work area. Safety vests will be worn at all times while conducting work. Multiple field staff will work together (buddy system) and spot traffic for each other if necessary. Avoid working with your back to traffic whenever possible. **Further details on traffic hazards are provided in Section 5.3.4.**
Hearing Damage due to Noise	Machinery creating more than 85 decibels TWA, less than 115 decibels continuous noise, or peak at less than 140 decibels.	Wear earplugs or protective ear covers when a conversational level of speech is difficult to hear at a distance of 3 feet; when in doubt, a sound level meter may be used on-site to document noise exposure.
Strains from Improper Lifting	Injury due to improper lifting techniques, overreaching/ overextending, or lifting overly heavy objects.	Use proper lifting techniques and mechanical devices where appropriate. The proper lifting procedure first involves testing the weight of the load by tipping it. If in doubt, ask for help. Do not attempt to lift a heavy load alone. Take a good stance and plant your feet firmly with legs apart, one foot farther back than the other. Make sure you stand on a level area with no slick spots or loose gravel. Use as much of your hands as possible, not just your fingers. Keep your back straight, almost vertical. Bend at the hips, holding load close to your body. Keep the weight of your body over your feet for good balance. Use large leg muscles to lift. Push up with one foot positioned in the rear as you start to lift. Avoid quick, jerky movements and twisting motions. Turn the forward foot and point it in the direction of the eventual movement. Never try to lift more than you are accustomed to lifting.
Cold Stress	Cold temperatures and related exposure.	Workers will wear appropriate clothing, stay dry, and take breaks in a heated environment when working in freezing temperatures. **Further details on cold stress are provided in Section 5.3.1.**

Hazard	Cause	Prevention
Heat Exposure	High temperatures exacerbated by PPE and/or dehydration.	Workers will ensure adequate hydration, shade, and breaks when temperatures are elevated. **Further details on heat stress are provided in Section 5.3.2.**
Accidents due to Inadequate Lighting	Improper illumination.	Work will proceed during daylight hours only or under sufficient artificial light.

Abbreviations:
PPE Personal protective equipment.
TWA Time-weighted average.

5.3.1 Cold Stress

Field work may be conducted in the winter months and exposure to cold temperatures may occur. Exposure to moderate levels of cold can cause the body's internal temperature to drop to a dangerously low level, causing hypothermia. Symptoms of hypothermia include slow, slurred speech; mental confusion; forgetfulness; memory lapses; lack of coordination; and drowsiness.

To prevent hypothermia, site personnel will stay dry and avoid exposure. Site personnel will have access to a warm, dry area, such as a vehicle, to take breaks from the cold weather and warm up. Site personnel will be encouraged to wear sufficient clothing in layers such that outer clothing is wind- and waterproof and inner layers retain warmth (wool or polypropylene), if applicable. Site personnel will keep hands and feet well protected at all times. The signs and symptoms and treatment for hypothermia are summarized below:

Signs and Symptoms

- Mild hypothermia (body temperature of 98–90°F)
  - Shivering
  - Lack of coordination, stumbling, fumbling hands
  - Slurred speech
  - Memory loss
  - Pale, cold skin
- Moderate hypothermia (body temperature of 90–86°F)
  - Shivering stops
  - Unable to walk or stand
  - Confused and irrational
- Severe hypothermia (body temperature of 86–78°F)
  - Severe muscle stiffness
  - Very sleepy or unconscious
  - Ice-cold skin
  - Death

Treatment of Hypothermia (proper treatment depends on the severity of the hypothermia.)

- Mild hypothermia
  - Move to warm area
  - Stay active
  - Remove wet clothes and replace with dry clothes or blankets and cover the head
  - Drink warm (not hot) sugary drinks
- Moderate hypothermia
  - All of the above, plus:
    - Call 911 for an ambulance
    - Cover all extremities completely
    - Place very warm objects such as hot packs or water bottles on the victim's head, neck, chest and groin
- Severe hypothermia
  - Call 911 for an ambulance
  - Treat the victim very gently
  - Do not attempt to re-warm—the victim should receive treatment in a hospital

Frostbite

Frostbite occurs when the skin actually freezes and loses water. In severe cases, amputation of the frostbitten area may be required. While frostbite usually occurs when the temperatures are 30°F or lower, wind chill factors can allow frostbite to occur in above-freezing temperatures. Frostbite typically affects the extremities, particularly the feet and hands. Frostbite symptoms include cold, tingling, stinging, or aching feelings in the frostbitten area followed by numbness and skin discoloration from red to purple, then to white or very pale skin. Should any of these symptoms be observed, wrap the area in soft cloth—do not rub the affected area—and seek medical assistance. Call 911 if the condition is severe.

Protective Clothing

Wearing the right clothing is the most important way to avoid cold stress. The type of fabric also makes a difference. Cotton loses its insulation value when it becomes wet. Wool, on the other hand, retains its insulation even when wet. The following are recommendations for working in cold environments:

- Wear *at least three layers* of clothing:
  - An outer layer to break the wind and allow some ventilation (like Gortex or nylon).
  - A middle layer of down or wool to absorb sweat and provide insulation even when wet.
  - An inner layer of cotton or synthetic weave to allow ventilation.
- Wear a hat—up to 40 percent of body heat can be lost when the head is left exposed.
- Wear insulated boots or other footwear.

- Keep a change of dry clothing available in case work clothes become wet.
- Do not wear tight clothing—loose clothing allows better ventilation.

Work Practices

- Drinking: Drink plenty of liquids, avoiding caffeine and alcohol. It is easy to become dehydrated in cold weather.
- Work Schedule: If possible, heavy work should be scheduled during the warmer parts of the day. Take breaks out of the cold in heated vehicles.
- Buddy System: Try to work in pairs to keep an eye on each other and watch for signs of cold stress.

5.3.2 Heat Stress

To avoid heat-related illness, current regulations in WAC 296-62-095 through 296-62-09570 will be followed during all outdoor work activities. These regulations apply to any outdoor work environment from May 1 through September 30, annually when workers are exposed to temperatures greater than 89°F when wearing breathable clothing, greater than 77°F when wearing double-layered woven clothing such as jackets or coveralls, or greater than 52°F when wearing non-breathing clothing such as chemical resistant suits or Tyvek. Floyd|Snider will identify and evaluate temperature, humidity, and other environmental factors associated with heat-related illness including but not limited to the provision of rest breaks that are adjusted for environmental factors, and encourage frequent consumption of drinking water. Drinking water will be provided and made readily accessible in sufficient quantity to provide at least 1 quart per employee per hour. All Floyd|Snider personnel will be informed and trained for responding to signs or symptoms of possible heat-related illness and accessing medical aid.

Employees showing signs or demonstrating symptoms of heat-related illness must be relieved from duty and provided with a sufficient means to reduce body temperature, including rest areas or temperature-controlled environments (i.e., air conditioned vehicle). Any employee showing signs or demonstrating symptoms of heat-related illness must be carefully evaluated to determine whether it is appropriate to return to work or if medical attention is necessary.

Any incidence of heat-related illness must be immediately reported to Floyd|Snider directly through the HSO/SS.

The signs, symptoms, and treatment of heat stress are given in the table below.

Condition	Signs/Symptoms	Treatment
Heat Cramps	Painful muscle spasms and heavy sweating.	Increase water intake, rest in shade/cool environment.
Heat Syncope	Brief fainting and blurred vision.	Increase water intake, rest in shade/cool environment.
Dehydration	Fatigue, reduced movement, headaches.	Increase water intake, rest in shade/cool environment.

Heat Exhaustion	Pale and clammy skin, possible fainting, weakness, fatigue, nausea, dizziness, heaving, sweating, blurred vision, body temperature slightly elevated.	Lie down in cool environment, increase water intake, and loosen clothing; call 911 for ambulance transport if symptoms continue once in cool environment.
Heat Stroke	Cessation of sweating, skin hot and dry, red face, high body temperature, unconsciousness, collapse, convulsions, confusion or erratic behavior, life threatening condition.	**Medical Emergency!! Call 911** for ambulance transport. Move victim to shade and immerse in water.

If site temperatures are forecast to exceed 85°F and physically demanding site work will occur in impermeable clothing, the HSO/SS will promptly consult with a certified industrial hygienist (CIH) and a radial pulse monitoring method will be implemented to ensure that heat stress is properly managed among the affected workers. The following heat index chart indicates the relative risk of heat stress:

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution Extreme Caution Danger Extreme Danger

5.3.3 Biohazards

Bees and other insects may be encountered during the field work tasks. Persons with allergies to bees will make the HSO/SS aware of their allergies and will avoid areas where bees are identified. Controls such as repellents, hoods, nettings, masks, or other personal protection may be used. Report any insect bites or stings to the HSO/SS and seek first aid if necessary.

Site personnel will maintain a safe distance from any urban wildlife encountered, including raccoons and rodents, to preclude a bite from a sick or injured animal. Personnel will be gloved and will use tools to lift covers from catch basins and monitoring wells.

5.3.4 Traffic Hazards

While work is being performed in the active areas, barricades should be utilized. Spotters will be used to ensure traffic is monitored during work activities because signs, signals, and barricades do not always provide appropriate protection. All workers will wear reflective neon/orange vests.

6.0 Site Monitoring

The following sections describe site monitoring techniques and equipment that will be used during site field activities. The HSO/SS, or a designated alternate, is responsible for site control and monitoring activities.

6.1 SITE MONITORING

Since the Site is currently active, and noise generating activities will be conducted within the site boundary, noise levels are expected to be less than the allowable levels.

Air monitoring will not be conducted as previous investigations have adequately characterized the type and concentrations of chemicals present at the Site, and the majority of site COCs are non-volatile. Visual monitoring for dust will be conducted by the HSO/SS to ensure that inhalation of contaminated soil particles does not occur. It is not anticipated that dust will be generated given that the Site is primarily concrete and asphalt. However, if visible dust is present in the work area, work will cease and the area will be cleared until the dust settles.

Concentrations of VOCs at the Site are low and less than OSHA standards and all work will be conducted outdoors in an open-air ventilated environment; vapor concentrations are not expected to exceed allowable levels. A photoionization detector (PID) will be used on-site to characterize soil samples collected. This PID will also be used to monitor vapor concentrations in breathing air of total VOCs in parts per million. Should the PID read a sustained concentration of total VOCs greater than the lowest action level sustained for 5 minutes, the HSO/SS will stop work and evacuate the area until vapor concentrations return to background levels. As needed, actions may be taken to reduce exposure to vapor concentrations in the work area by covering exposed soil or drilling cuttings, and leaving the work area until odor dissipates.

The HSO/SS will visually inspect the work site at least daily to identify any new potential hazards. If new potential hazards are identified, immediate measures will be taken to eliminate or reduce the risks associated with these hazards.

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7.0 Hazard Analysis by Task

The following table identifies potential hazards associated with each task listed in Section 3.2 of this HASP. Tasks have been grouped according to the types of potential hazard associated with them.

Task	Potential Hazard
Tidal Survey	Chemical hazards include potential dermal or eye exposure to contaminants in water. Physical hazards include slip, trip, or fall hazards; drowning; heat and cold exposure hazards; and biological hazards.
Sampling of Materials from Pipes and Laterals	Chemical hazards include potential dermal or eye exposure to contaminants in water and solids. Physical hazards include slip, trip, or fall hazards; heat and cold exposure hazards; and biological hazards.
Installing Soil Borings, and Soil and Groundwater Sampling	Exposure to loud noise; overhead hazards; head, foot, ankle, hand, and eye hazards; electrical and mechanical hazards; lifting hazards; dust inhalation hazards; potential dermal or eye exposure to site contaminants in groundwater and soil; fall hazards; traffic hazards; and heat and cold exposure hazards.

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8.0 Personal Protective Equipment

All work involving heavy equipment and drilling, including contractor oversight, will proceed in Level D PPE, which shall include hard hat, steel-toed boots, hearing protection, eye protection, and protective gloves.

All personnel will be properly fitted and trained in the use of PPE. The level of protection will be upgraded by the HSO/SS whenever warranted by conditions present in the work area. The HSO/SS will periodically inspect equipment such as gloves and hard hats for defects.

For all work involving potential exposure to sediment, soil, or groundwater, workers will wear Nitrile gloves and Level D PPE.

Safety vests will be worn when working around heavy equipment and in active site areas.

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9.0 Site Control and Communication

9.1 SITE CONTROL

The Site is active and fenced. Pedestrians and other unauthorized personnel will not be allowed in the work area. Access to the work site will be restricted to designated personnel. The purpose of site control is to minimize the public's potential exposure to site hazards, to prevent vandalism in the work area and access by children and other unauthorized persons, and to provide adequate facilities for workers.

Work area controls and decontamination areas will be provided to limit the potential for chemical exposure associated with site activities, and transfer of contaminated media from one area of the Site to another. The support zone (SZ) for the work area includes all areas outside the work area and decontamination areas. An exclusion zone (EZ), contamination reduction zone (CRZ), and SZ will be set up for work being conducted within the limits Site. Only authorized personnel shall be permitted access to the EZ/CRZ. Staff will decontaminate all equipment and gear as necessary prior to exiting the work area.

9.2 COMMUNICATION

All site work will occur in teams and the primary means of communication on-site and with off-site contacts will be via cell phones. An agreed-upon system of alerting via air horns and/or vehicle horns may be used around heavy equipment to signal an emergency if shouting is ineffective.

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10.0 Decontamination

Decontamination procedures will be strictly followed to prevent off-site spread of contaminated sediment, soil, or water. Decontamination effectiveness will be assessed by visual inspection by the HSO/SS. Refer to the Sampling Analysis Plan/Quality Assurance Project Plan (SAP/QAPP; Appendix B of the Work Plan) for additional details.

Before eating, drinking, and use of tobacco, hands must be thoroughly washed.

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11.0 Emergency Response and Contingency Plan

This section defines the emergency action plan for the Site. It will be rehearsed with all site personnel and reviewed whenever the plan is modified or the HSO/SS believes that site personnel are unclear about the appropriate emergency actions.

A point of refuge will be identified by the HSO/SS and communicated to the field team each day. This point will be clear of adjacent hazards and preferably upwind or crosswind for the entire day. In an emergency, all site personnel and visitors will evacuate to the point of refuge for roll call. It is important that each person on-site understand their role in an emergency, and that they remain calm and act efficiently to ensure everyone's safety.

After each emergency is resolved, the entire project team will meet and debrief on the incident—the purpose is not to fix blame, but to improve the planning and response to future emergencies. The debriefing will review the sequence of events, what was done well, and what can be improved. The debriefing will be documented in a written format and communicated to the PM. Modifications to the emergency plan will be approved by the PM.

Reasonably foreseeable emergency situations include medical emergencies, accidental release of hazardous materials (such as gasoline or diesel) or hazardous waste, and general emergencies such as vehicle accident, fire, thunderstorm, and earthquake. Expected actions for each potential incident are outlined below.

11.1 MEDICAL EMERGENCIES

In the event of a medical emergency, the following procedures should be used:

1. Stop any imminent hazard if you can safely do so.
2. Remove ill, injured, or exposed person(s) from immediate danger if moving them will clearly not cause them harm and no hazards exist to the rescuers.
3. Evacuate other on-site personnel to a safe place in an upwind or crosswind direction until it is safe for work to resume.

   If serious injury or life-threatening condition exists, call 911 for paramedics, the fire department, and police.

   Clearly describe the location, injury, and conditions to the dispatcher. Designate a person to go to the site entrance and direct emergency equipment to the injured person(s). Provide the responders with a copy of this HASP to alert them to chemicals of potential concern.
4. Trained personnel may provide first aid/cardiopulmonary resuscitation if it is necessary and safe to do so. Remove contaminated clothing and PPE only if this can be done without endangering the injured person.
5. Call the PM and HSO/SS.
6. Immediately implement steps to prevent recurrence of the accident.

A map showing the nearest hospital location is attached to this HASP (Figure C.2; refer to Section 2.0 for number and address).

11.2 ACCIDENTAL RELEASE OF HAZARDOUS MATERIALS OR WASTES

1. Evacuate all on-site personnel to a safe place in an upwind direction until the HSO/SS determines that it is safe for work to resume.
2. Instruct a designated person to contact the PM and confirm a response.
3. Contain the spill, if it is possible and can be done safely.
4. If the release is not stopped, call 911 to alert the fire department.
5. Contact the Washington State Emergency Response Commission at 1-800-258-5990 to report the release.
6. Initiate cleanup.
7. The PM will coordinate follow-up written reporting to the Washington State Department of Ecology in the event of a reportable release of hazardous materials or wastes.

11.3 GENERAL EMERGENCIES

In the case of fire, explosion, earthquake, or imminent hazards, work shall be halted and all on-site personnel will be immediately evacuated to a safe place. The local police/fire department shall be notified if the emergency poses a continuing hazard by calling 911.

In the event of a thunderstorm, outdoor work will be discontinued until the threat of lightning has abated. During the incipient phase of a fire, the available fire extinguisher(s) may be used by persons trained in putting out fires, if it is safe for them to do so. Contact the fire department as soon as feasible.

11.4 EMERGENCY COMMUNICATIONS

In the case of an emergency, an air horn or car horn will be used as needed to signal the emergency. One long (5-second) blast will be given as the emergency/stop work signal. If the air horn is not working, a vehicle horn and/or overhead waving of arms will be used to signal the emergency. In any emergency, all personnel will evacuate to the designated refuge area and await further instruction.

11.5 EMERGENCY EQUIPMENT

The following minimum emergency equipment will be readily available on-site and functional at all times:

- First Aid Kit—contents approved by the HSO/SS.
- Sorbent materials capable of absorbing the volume of liquids/fuels brought to the Site by Floyd|Snider personnel.
- Portable fire extinguisher (2-A:10 B/C min).
- A copy of the current HASP.

12.0 Administrative

12.1 MEDICAL SURVEILLANCE

Floyd|Snider personnel involved with field activities must be covered under Floyd|Snider's medical surveillance program that includes biennial physical examinations. These medical monitoring programs must be in compliance with all applicable worker health and safety regulations.

12.2 RECORD KEEPING

The HSO/SS, or a designated alternate, will be responsible for keeping attendance lists of personnel present at site health and safety meetings, accident reports, and signatures of all personnel who have read this HASP.

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13.0 Approvals

______________________________ ______________

Project Manager Date

______________________________ ______________

Project Health & Safety Officer Date

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14.0 Signature Page

I have read this Heath and Safety Plan and understand its contents. I agree to abide by its provisions and will immediately notify the HSO/SS if site conditions or hazards not specifically designated herein are encountered.

Name (Print)	Signature	Date	Company/Affiliation

Jorgensen Forge Outfall Site
Seattle, Washington

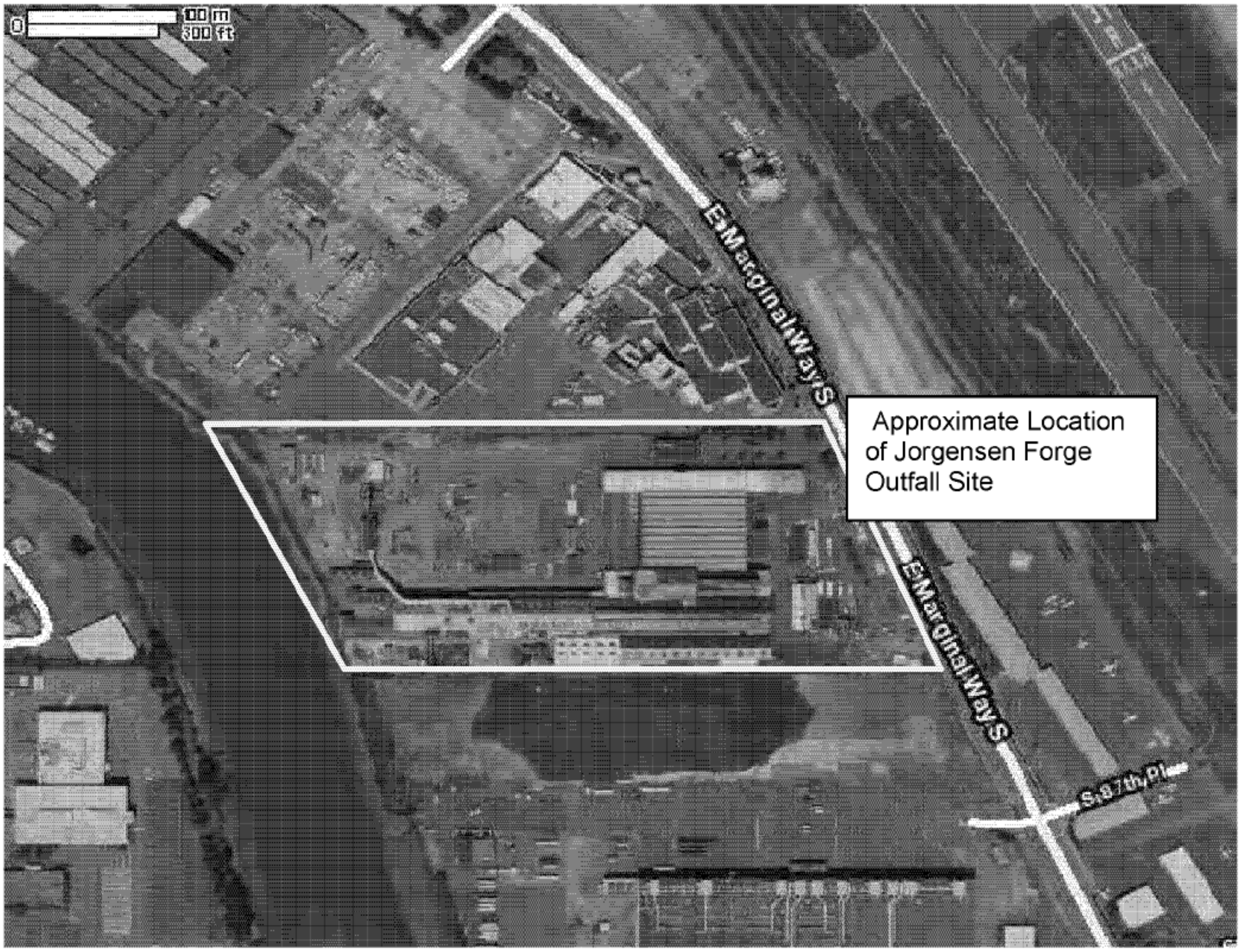
Source Control Action

15-inch and 24-inch Pipes Cleanout Work Plan

Appendix C
Health and Safety Plan

Figures

FINAL



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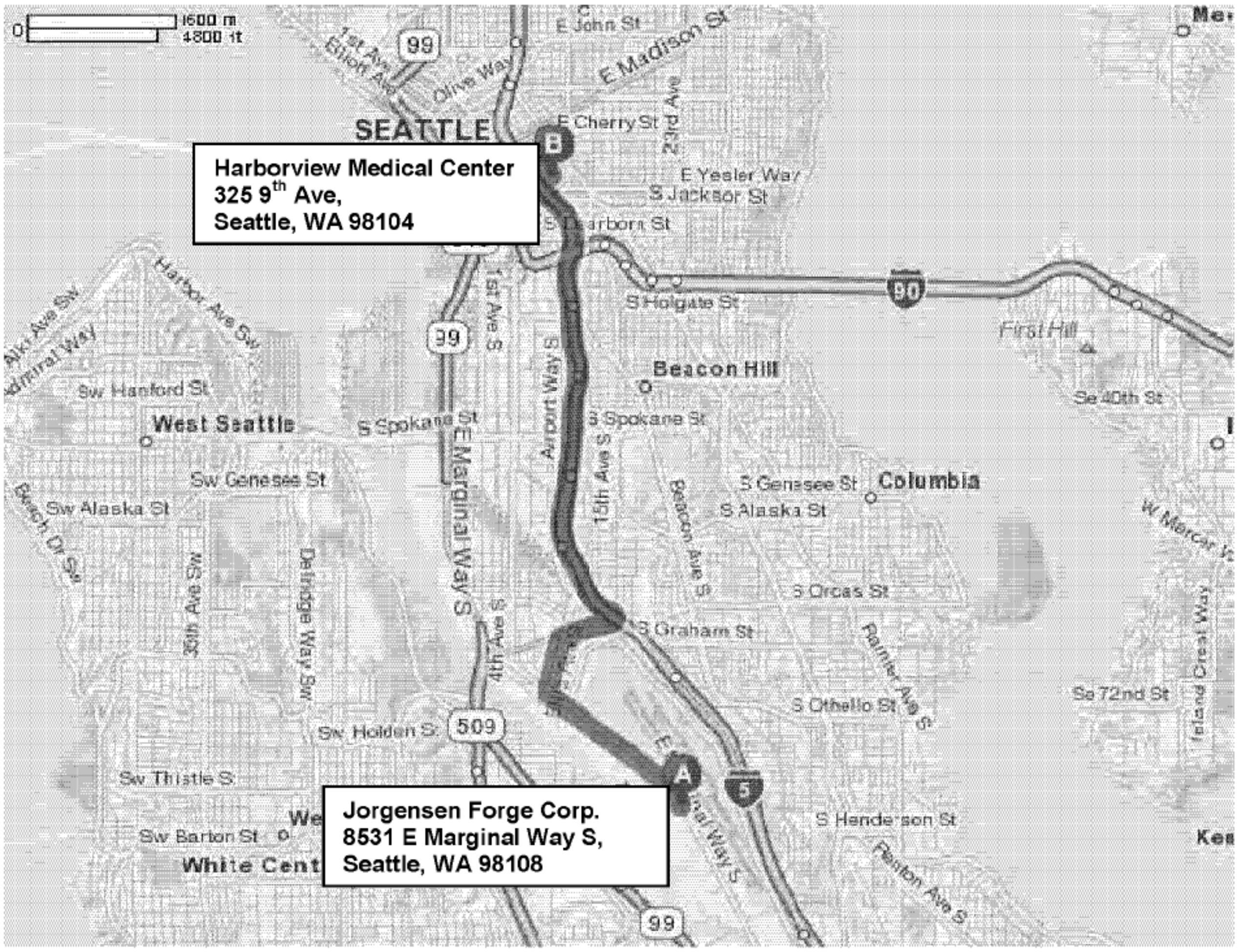
15-inch and 24-inch Pipes Cleanout Work Plan Jorgensen Forge Outfall Site Source Control Action Seattle, Washington	Figure C.1 Project Location Map



Directions to Hospital from Site:

- Start going Northwest on East Marginal Way S toward S 81st Place
- Turn RIGHT onto Corson Ave S
- Turn RIGHT onto S Bailey St
- Merge onto I-5 NORTH
- Exit at Dearborn St/ James St, Exit 164A
- Take the James St exit
- Turn RIGHT onto James St
- Turn RIGHT onto 9th Ave
- Hospital in on the RIGHT

FLOYD | SNIDER strategy • science • engineering	**15-inch and 24-inch Pipes Cleanout Work Plan Jorgensen Forge Outfall Site Source Control Action Seattle, Washington**	Figure C.2 Route to Hospital Map

Jorgensen Forge Outfall Site
Seattle, Washington

Source Control Action

15-inch and 24-inch Pipes Cleanout Work Plan

Appendix C
Health and Safety Plan

Attachment C.1

FINAL

Attachment C.1
Daily Tailgate Safety Meeting

Date: ______ Time:______Site Safety Officer: _______________ Site Supervisor: _______________

Emergency Contact: 911 Site Address: Jorgensen Forge - 8531 E Marginal Way S

Meeting Locations: Emergency Responders____________________Evacuation_______________

Hazards and Safety Protocols by Work Zone

WORK ZONE: ________________________________ Zone Safety Officer: ____________________

Physical Hazards:____

Chemical Hazards: ____

Environmental Hazards:____

Personal Protection:____

Decontamination:____

Special Site Considerations: ____

WORK ZONE: ________________________________ Zone Safety Officer: ____________________

Physical Hazards:____

Chemical Hazards: ____

Environmental Hazards:____

Personal Protection:____

Decontamination:____

Special Site Considerations: ____

PID Usage:

Work Zone	Material	Monitoring Frequency	Compound	Ionization Potential	Lamp	Correction Factor	Human Health Action Level

Tailgate Safety Meeting Attendees

Project: Removal Action Jorgensen Forge Outfall Site

Meeting Conducted by: ________________ ________________ ________

Name Signature Date

Name/Company (printed)	Signature	Dashboard Card Received (initials)